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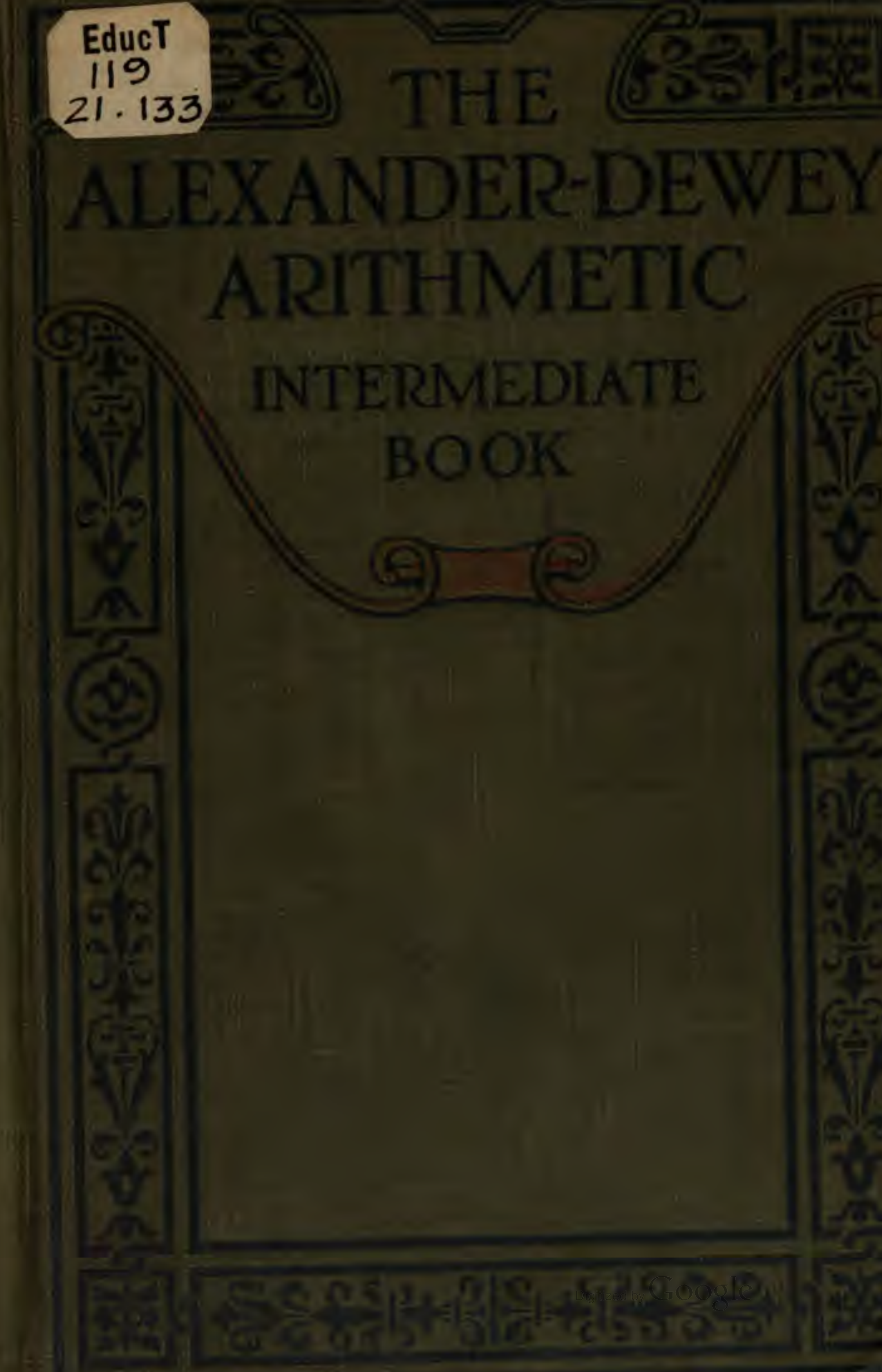

THE ALEXANDER-DEWEY ARITHMETIC

INTERMEDIATE BOOK

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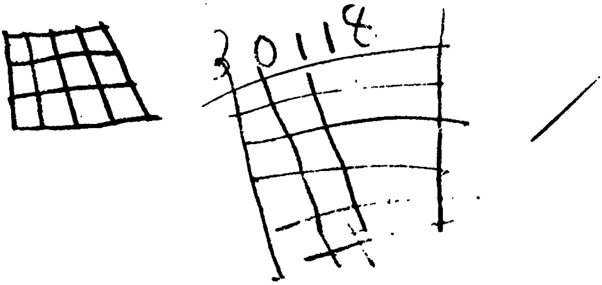

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units = 1 doz
doz = 1 gross
144 units = 1 "
12 gross = 1 great gross
a score is 20 units

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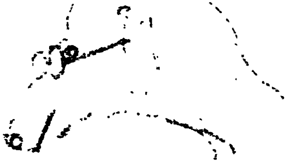

THE

ALEXANDER-DEWEY ARITHMETIC

INTERMEDIATE BOOK

BY

GEORGIA ALEXANDER

DISTRICT SUPERINTENDENT OF INDIANAPOLIS SCHOOLS

EDITED BY

JOHN DEWEY

PROFESSOR OF PHILOSOPHY IN COLUMBIA UNIVERSITY

The problem is always the same: to interest the pupil, to induce research, to give him the notion continually, the illusion, if you please, that he is discovering for himself that which is being taught him. — M. LAISANT.

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PREFACE

THIS series of arithmetics arises from the realization that the mathematics taught in the schools of a democracy must function in:

1. Clear and independent thinking as a preparation for business, science and industry.
2. Skill in mathematical computation.
3. Civic responsibility which will carry into action whatever is needed for the welfare of the community.

That these ends may be accomplished, new arithmetical ideas have been introduced by means of the socialized recitation, thus affording the pupil an impelling incentive, cultivation of initiative and judgment, and a desire to check results. The arithmetical ideas gained through this social introduction are made automatic through scientific practice which later culminates in their application to new concrete situations. Reviews are both constant and varied. Fully fifty per cent of the work is to be performed without pencil. The subject matter is of contemporary interest which brings into the otherwise isolated schoolroom the great world where mathematics are found in every basic activity. The desideratum is an intelligent, responsible, skilful pupil.

The respective contributions of the author and the editor of the series are perhaps sufficiently indicated by the use of these terms. The editor has not confined his attention to allowing the use of his name, but has made suggestions as to the underlying principles, has suggested experiments to be tested in schoolroom practice, has read and criticised the text and is jointly responsible for its present form. The specific problems and principles have been worked out in the schoolroom under the direct supervision of the author and tested till they were satisfactory. Grateful acknowledgment is made to the score of classroom teachers who have so generously and intelligently aided in testing the various lessons, and to Mrs. John Dewey, who has read the text critically and made valuable suggestions.

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The entire book is based on induction. Special exercises marked (*) should be assigned for study by the child alone. Exercises marked (†) are for exceptional classes only.

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INTERMEDIATE ARITHMETIC

PART I—SECTION ONE

1. *Meadowbrook Farm: I — Buying a Home.*

Mr. Henderson (*reading aloud from morning paper*):

For Sale—Farm of 16 acres; 10 miles south of city; near traction, church and graded school; eight-room house; 10 acres in cultivation; rest in timber and pasture. Trade in whole or part for city property. Lennis and Robbins, Real Estate Agents.

Mrs. Henderson: Just what we are looking for!

The Children: Oh, father, do buy it!

Mr. Henderson: I will first talk with Mr. Lennis. If it seems promising we will then go to look at it.

AT THE REAL ESTATE OFFICE

Mr. Lennis: Good morning, Mr. Henderson. What can I do for you?

Mr. Henderson: Good morning. I came to ask about the 16-acre farm which you have advertised. How much do you ask for it?

1. *Mr. Lennis:* W. H. Johnson is the owner. For immediate sale he will take $125 an acre. He values the house and farm buildings at $3,500. The total price is therefore $——.

2. *Mr. Henderson:* Five years ago I paid $4,500 for my property at 720 Stevens Street. Since then I have spent $500 on improvements. If on looking at the farm I like it, I am willing to trade at $——, just what my property cost me.

3. *Mr. Lennis:* That would leave a cash difference of $——. Will it be convenient for you to go out with me to look at the farm this morning?

Mr. Henderson. I wish to take my family out with me. I think we can go at 10 o'clock.

4. Imagine yourself a member of the family. Make a problem that will relate to the trip and that can be solved by the class without a pencil.

5. A few days later, Mr. Henderson and Mr. Johnson decide to trade. Mr. Henderson receives from Mr. Johnson a bank check for the difference between the price of the city property and that of the farm. Imagine yourself to be Mr. Johnson and write out an order on the People's National Bank. Model your order after a real bank check.

Supplement this and future lessons with data from actual transactions. For example, in this lesson, ask pupils to bring in advertisements of farms for sale, particularly those with illustrations such as appear in farm magazines. Show the class a property deed and a bank check. Explain in a *simple way* how real estate transfers are conducted. Vitalize the work by dramatization, and by every other means make the conditions as real as possible.

2. *Notation to Millions.*

When more than three figures are used to express a whole number they are usually separated by commas into groups or periods of three figures each. In each period are three places or orders: Units, tens, hundreds.

Periods:	Millions			Thousands			Units		
	Hundreds	Tens	Units	Hundreds	Tens	Units	Hundreds	Tens	Units
Orders:	1	3	4 ,	6	0	7 ,	2	0	9

Read aloud. Find sum:

1.	2.	3.	4.
30,170	4,140	390,064	47,004
501,909	987,007	6,060	9,005
17,991	56,578	87,068	600,314
127,703	100,100	106,601	18,790
706,859	40,504	800,008	16,016
70,070	602,206	76,076	983,000

Continue.

The use of *and* should be reserved for the decimal point.

3. *Subtract at sight:*

1.	3.	5.	7.
40,362	32,543	57,654	68,565
27,689	18,968	29,678	49,679

2.	4.	6.	8.
67,432	85,326	34,327	52,422
28,573	35,457	14,578	19,963

4. *Find quotient:*

1. 731,301 ÷ 91
2. 387,396 ÷ 48
3. 461,601 ÷ 57
4. 410,913 ÷ 54
5. 225,661 ÷ 37
6. 349,476 ÷ 39
7. 628,648 ÷ 67
8. 411,256 ÷ 37
9. 549,130 ÷ 68

Make habitual the checking of results. Teach the class to use the nearest "round number" for a trial divisor and to estimate partial products before writing.

5. *Oral Exercises.*

1. Count by 2's to 31, beginning with 1. Count back.

2. Count by 3's to 31, beginning with 1. Count back.

3. If 7 barrels of flour cost $84, what will 1 barrel cost?

4. Alice had 15 beads. She lost all but 3, but found $\frac{1}{2}$ the number she lost. How many had she then?

5. How many 4-ounce packages can be made from $\frac{1}{2}$ pound of tea?

6. If 5 books cost $10, how much will 15 such books cost? Two ways.

7. Nine yards of cloth cost $45. How much will 3 yards cost? Two ways.

8. From a drove of 90 sheep, 45 were sold. How many sheep remained? What part of the drove remained?

9. How much must be paid for 6 cords of stove wood at 2\frac{1}{2}$ a cord?

10. I bought 4 quarts of strawberries at 30 cents a quart and paid for them with chestnuts at 8 cents a quart. How many quarts of chestnuts did it take?

11. Beginning with 7, add 6, subtract 3, multiply by 4, divide by 2, multiply by 3, add 8, subtract 9. What is the result?

Exercises of this type should be given frequently.

12. A man leaves his office at 5:20 P.M. When he reaches home, 40 minutes later, what time is it?

13. A boy borrowed 25 cents from his father and then earned 5 times as much. How much had he then?

14. If a bird flew 20 miles an hour for 2$\frac{1}{2}$ hours, how far did it fly?

15. If a certain quantity of provisions will last one man 250 days, how long will it last 13 men?

16. How much will 2 pairs of shoes cost at $5.75 a pair?

6. *Common Fractions — Review of Halves and Fourths.*

a. Divide a watermelon into two equal parts. Each part is called one —— of the watermelon.

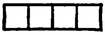
b. Divide a watermelon into four equal parts. Each part is called one —— of the watermelon.

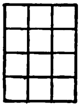
c. In the whole watermelon are ? /2 ? /4 ?

d. How many fourths in $\frac{1}{2}$ of a watermelon?

7.* *Using Units of Different Sizes.*

If possible obtain squared paper. If not, it will be well for pupils to rule several large sheets into half-inch squares.

a. For study. Using 4 squares  as a unit or whole, we have:



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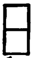
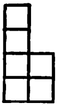


$\frac{1}{2}$



$1\frac{1}{2}$

b. Use 6 squares as a unit and show: 1; 2; $\frac{1}{2}$; $2\frac{1}{2}$.

c. Use 8 squares as a unit and show: 1; $\frac{1}{2}$; $\frac{1}{4}$; $\frac{3}{4}$; $2\frac{1}{4}$.

d. Use 12 squares as a unit and show: 1; 2; $1\frac{1}{2}$; $2\frac{3}{4}$; $3\frac{1}{4}$.

Continue.

Teacher will please read the Preface and the Table of Contents.
Lessons marked * should be assigned for study previous to the recitation. See Suggestions to Teachers.

8. *Written Problems.*

1. Mrs. Bronson bought 16 yards of cloth at $2.50 a yard. How much did she pay for it?

2. A grocer bought 24 dozen eggs. He sold 6 dozen to one customer and 3 dozen to another. How much did he receive for them at 50 cents a dozen? How much are the remaining eggs worth at the same price?

3. On June 12, Albert weighed 96 pounds. On August 12, he weighed 102½ pounds. How much had he gained in the two months?

4. At a county fair, 1,000 twenty-five cent tickets were sold in one day. How much were the total gate receipts for that day?

5. A charity organization gave a summer outing to 240 boys and one half as many girls. How many more boys went than girls?

6. Mr. Anderson paid $6.25 for a pair of shoes and $42.75 for a suit of clothes. How much more did his suit cost than his shoes?

7. One bale of cotton weighs 500 pounds. How much is it worth at 10 cents a pound?

8. Make a drawing of your schoolroom floor, using ½ inch to represent one yard of the floor. Draw in your own desk and your teacher's desk. The class should measure the floor. Use only multiples of 3.

9. A bakery used 119 barrels of flour in 14 weeks. How many barrels did it average for one week?

Make sure that pupils understand the term "average." For example, in the problem above, the bakery might have used 7 barrels one week and 10 another, but in the course of 14 weeks the average was ——.

10. Make an original problem about a boy and his kite, that the class can solve without pencil.

By daily practice habituate the pupils to estimate results and check them.

11. If each of 16 baskets contains 72 eggs, how many more must be bought to bring the total to 1440 eggs?

12. A cask of oil lasted 192 days, 1 pint a day being used. How many gallons did the cask hold?

13. A piece of meat weighed 10 pounds 9 ounces. While cooking it lost 2 pounds 5 ounces. What was its weight after cooking?

14. A grocer bought 20 dozen eggs for $8 and sold them at 67½ cents a dozen. How much was his profit?

15. A garden is 84 feet long and 68 feet wide. How many feet of fence will it need?

16. If 9 men can do a piece of work in 180 days, how long will it take 18 men? Two ways.

17. A man earns $80 in a certain time. His son earns ½ as much and his daughter $23¼. How much do they all earn?

18. I have 8 boxes of currants, each weighing 7 pounds. How much did they cost at 12½ cents a pound?

19. There are 316 lemons in one box, 531 in another, and 434 in another. If they are all taken out and packed in 21 smaller boxes of equal size, how many can be put into each box?

20. During February the daily sale of a newspaper was as follows:

Monday	1506	1482	1286	1108
Tuesday	1418	1289	1750	1369
Wednesday	1190	1261	1396	1589
Thursday	1489	1369	1487	1643
Friday	1206	1224	1325	1560
Saturday	1501	1651	1437	1509

Find the total number sold each week, and each day of the week during the month.

9. *Add — Oral.*

$$\begin{array}{ccccccccc} 6 & 5 & 7 & 8 & 9 & 9 & 6 & 3 & 9 \\ \underline{8} & \underline{7} & \underline{8} & \underline{5} & \underline{7} & \underline{9} & \underline{5} & \underline{9} & \underline{4} \end{array}$$

$$\begin{array}{ccccccccc} 4 & 8 & 7 & 8 & 6 & 7 & 9 & 6 & 9 \\ \underline{7} & \underline{4} & \underline{7} & \underline{3} & \underline{9} & \underline{6} & \underline{8} & \underline{6} & \underline{5} \end{array}$$

Use for daily exercise until a majority of the class can in 10 seconds give sums of all the combinations.

> A whole number is called an integer. The number 5 is an integer. One or more of the equal parts of a whole or unit is called a fraction. The number $\frac{3}{4}$ is a fraction.

10. *Written Dictation.*

1. Write in words 1,010. **Teacher write figures on blackboard.**

2. Write 96 in Roman numerals.

3. What number must be added to 17 to make 31?

4. If 2 grapefruit sell for 25 cents, how much will 1 dozen cost?

5. Albert left home on his bicycle at 8 o'clock in the morning and returned at 12:30 P.M. How long was he away from home?

It will be found profitable to use an exercise of this type daily as a test of work taught.

11. *Complete and learn:*

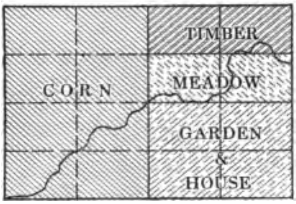
a.	*b.*
$1 \times 11 = 11$	$11 \div 11 = 1$
$2 \times 11 = 22$	$22 \div 11 = 2$
$3 \times 11 = 33$	$33 \div 11 = 3$
to	to
$12 \times 11 = 132$	$132 \div 11 = 12$

12. *Meadowbrook Farm : II — The Plan of the Farm.*

See previous lesson on page 1.

1. Meadowbrook Farm extends 64 rods along the road and 40 rods back. One rod is $16\frac{1}{2}$ feet long. How many feet long and how many feet wide is the farm?

2. Draw the plan of Meadowbrook Farm on a scale of $\frac{1}{8}$ of an inch to the rod and divide it into 16 equal parts as shown.



Make sure that every pupil in the class can measure $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{8}$ of an inch.

3. What part of Meadowbrook Farm is planted in corn? What part is timber? Meadow? How many acres in each? (Meadowbrook Farm contains 16 acres.)

4. The whole farm $= \frac{1}{2}$ (corn) $+ \frac{1}{4}$ (?) $+ \frac{1}{8}$ (?) $+ \frac{1}{8}$ (?).

5. Stake off a real acre in the school yard or elsewhere. *One acre contains* 160 *square rods.* The most convenient shape will probably be 16 rods long and 10 rods wide. What other dimensions might it have?

13. *Write in figures:*

1. Six million sixty thousand six.

2. Five hundred six thousand fifty-six.

3. Seventy-one million seven thousand seven hundred.

4. Three hundred seven million three hundred seven thousand.

5. Fifty million fifty.

6. Four million forty-three.

7. Thirty thousand three.

Continue.

Complete and learn:

—— feet make 1 rod.
—— square rods make 1 acre.

14. *Add without pencil:*

1. 26 + 32 = 58

Think: $\left\{\begin{array}{l}26 + 30 = 56\\ 56 + \ \ 2 = 58\end{array}\right.$ Say: 56, 58.

2.	57	**4.**	45	**6.**	25	**8.**	67	**10.**	75
	32		31		14		31		13
3.	89	**5.**	63	**7.**	47	**9.**	75	**11.**	58
	20		14		42		22		21

15. *Find the product:*

1. 6875 × 809
2. 7864 × 580
3. 8749 × 607
4. 8560 × 970
5. 3897 × 805
6. 4876 × 760
7. 9587 × 680
8. 3984 × 906
9. 7869 × 507
10. 8567 × 780
11. 5397 × 905
12. 4768 × 670

16. *Mr. Johnson's Restaurant: I — Oral.*

A class visit to a restaurant during which the pupils gather additional data for problems will be found highly profitable.

1. After Mr. Johnson sold Meadowbrook Farm, he came to the city and bought a restaurant. He paid $1,000 in cash and gave his note for 3 times that amount. What was the sale price of the restaurant? What part was cash?

2. The tables in the dining-room were 4 feet square. How large were the table cloths if they dropped $\frac{1}{4}$ of a foot on each side?

3. One week Mr. Johnson had 1600 napkins laundered. The next week he had $\frac{1}{8}$ more napkins laundered. How many napkins were laundered the second week?

4. On each of the 24 tables in the restaurant was a jar that held a quarter of a pint of mustard. *One fourth of a pint is a gill.* How many quarts of mustard in all the jars?

5. One pound of coffee will make 30 cups. Mr. Johnson used $5\frac{1}{2}$ pounds each day on the average. How many cups did he make?

6. Mr. Johnson bought Jersey milk at 30¢ a gallon and served it in half-pint bottles at 5¢ each. What was his profit on one gallon?

7. Eighteen loaves of white bread and 13 loaves of graham bread were used in one day. How many loaves were used in all?

17. *Comparison of Halves, Fourths and Eighths.*

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</table>

Colored crayons can be used effectively to emphasize fractional relations. For example, halves can be in one color, fourths in another, etc.

Complete:

a. $1 = \frac{2}{2}$
$1 = \frac{4}{4}$
$1 = \frac{8}{8}$

b. $\frac{1}{2} = \frac{2}{4}$
$\frac{1}{2} = \frac{4}{8}$
$\frac{2}{2} = \frac{8}{8}$

c. $\frac{1}{4} = \frac{2}{8}$
$\frac{2}{4} = \frac{4}{8}$
$\frac{3}{4} = \frac{6}{8}$
$\frac{4}{4} = \frac{8}{8}$

See previous lessons, pp. 5 and 9.

18. *Suggestive Questions in Fractions.*

1. How many ounces in $\frac{1}{2}$ pound? In $\frac{1}{4}$ pound?

2. A peck measure is what part of a bushel? A quart is what part of a peck? Of a gallon?

3. How many inches in $\frac{1}{2}$ of a foot? In $\frac{1}{4}$? In $\frac{3}{4}$?

4. When $\frac{1}{2}$ bushel of potatoes costs $1.50, what is the cost of $\frac{1}{4}$ of a bushel?

5. If $\frac{1}{2}$ of a yard of velvet costs $2, how much will $\frac{1}{8}$ yard cost?

6. If $\frac{1}{4}$ dozen oranges costs 10¢, what will $\frac{1}{2}$ dozen cost?

7. When $\frac{1}{2}$ ton of hay costs $15, how much is $1\frac{1}{2}$ tons worth?

8. I bought $1\frac{1}{4}$ yards of ribbon. How many inches did I buy?

9. How many minutes in $2\frac{1}{2}$ hours? In $1\frac{1}{4}$ hours?

10. One pint is what fraction of a quart? Of a gallon?

11. Write 3 quarts as a fraction of a peck. Write 3 pecks as a fraction of a bushel.

12. When $\frac{3}{4}$ of a gallon of syrup costs $1.20, how much will $\frac{3}{8}$ of a gallon cost?

13. Make a drawing of a pie so as to show $\frac{1}{4}$ taken out and the rest undivided. What fraction of the whole is the larger piece? The larger piece is how many times the smaller in size?

14. Eight boys, having gathered a bag full of nuts, agree to share them equally. What part of the nuts did one boy get? Six boys?

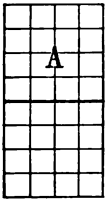
15. When we say we have $\frac{5}{8}$ of anything, what do we mean?

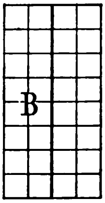
16. How many ounces in $\frac{3}{4}$ of a pound? In $\frac{6}{8}$ of a pound?

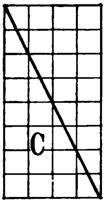
17. Four ounces are what fraction of a pound? Twelve ounces?

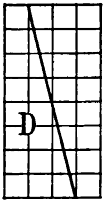
18. Write 3 quarts as a fraction of a gallon. Write 3 pints as a fraction of a gallon.

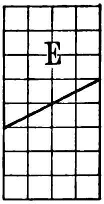
19.











† Imagine a piece of ground 8 rods long and 4 rods wide and worth $1,000. Divide it in five different ways as indicated above and tell the money value of each of the lettered portions.

It will be found profitable to cut paper to scale and subdivide by cutting.

19. *Find quotient:*

1. 265,312 ÷ 29
2. 912,109 ÷ 57
3. 795,388 ÷ 59
4. 626,444 ÷ 78
5. 812,127 ÷ 36
6. 931,857 ÷ 38
7. 219,307 ÷ 27
8. 115,920 ÷ 79
9. 711,206 ÷ 47
10. 291,972 ÷ 48
11. 482,478 ÷ 76
12. 365,640 ÷ 89

† See Table of Contents.

20. *Mr. Johnson's Restaurant: II — Written.* divide

1. One day Mr. Johnson bought 3 crates of extra fine strawberries for $18. In one crate are 24 quarts. What was the price per quart? multiply

2. He sold 300 orders of strawberries at 20¢ a dish. How much profit did he clear on the berries, allowing an expense of $12 for the sugar and cream served with them?

3. Mr. Johnson served 360 orders of bread one day for which he received 5¢ an order. The bread had cost him $9. How much was his profit? x 4

4. An order consisted of 3 pieces of bread or $\frac{1}{4}$ of a loaf. Into how many pieces was each loaf cut?

5. One pound of butter was cut into 40 small pieces which sold at 2¢ each. How much was realized from $6\frac{1}{4}$ pounds, if the butter cost $3[illegible]

6. Mr. Johnson served 75 plates of tomato salad one noon at 20¢ a plate. His profit on the salad was $4.50. How much had it cost him?

7. The second spring Mr. Johnson covered the floor of his restaurant with linoleum at $2 a square yard. Draw a plan of the floor, which was 60 feet long and 30 feet wide. How much did the linoleum cost?

8. One peck of butter beans when served with cream dressing made 10 quarts. What part of the original quantity did the dressing add?

9. One 5-pound box of loaf sugar contains 4 layers of pieces. In each layer are 68 pieces. How many pieces of sugar in the whole box?

10. If each salt shaker holds 1 ounce of salt, how many ounces are required to fill 2 dozen shakers on the tables?

11. A cake 12 inches wide and 24 inches long can be cut into how many slices 2 inches wide and 6 inches long? Drawing.

21. *Written Problems.*

1. When potatoes sell at 48 cents a peck, how much must be paid for a bushel and a half?

2. How many handkerchiefs 18 inches square can be cut from goods 4 yards long and ½ yard wide?

3. Which would you rather have, \$¼ or \$⅕? What is the difference?

4. Last winter eggs cost 76 cents a dozen. In March they dropped to 38 cents. What difference did that make in the cost of 5 dozen? Have you a suggestion about preserving eggs for winter use?

5. During one month the United States shipped nine hundred thousand bushels of wheat to Europe. Write that number in figures.

6. Which is larger and how much: LVI or LXIX?

7. Elsie bought 6 War Savings Stamps at \$4.12 each in January, 1918. They are worth \$30 in 1923. What is the gain?

8. Two lemons can be bought for 5 cents. At that rate, what is the cost of one dozen?

9. A principal had 100 thrift stamps. She sent ½ of them to one room, ¼ to another, and ⅕ to a third room. How many stamps had she left?

10. The United States declared herself an independent nation in 1776. How many years has she been an independent nation?

11. A certain fifth-grade school made a Christmas quilt for a hospital. They put 9 squares in a block. The quilt was 7 blocks wide and 10 long. How many squares were in it?

12. Our school garden is 18 feet long and 9 feet wide. How many square yards does it contain?

13. A carpenter saves \$39 a month. How long will it take him to save \$702?

22. *Write in the order of value beginning with the lowest:*

a. $11\frac{1}{2}$; 7; $10\frac{1}{2}$; 9; $7\frac{1}{2}$; 10; 8; $9\frac{1}{2}$; 11; $8\frac{1}{2}$.

b. $2\frac{3}{4}$; $1\frac{1}{4}$; 3; $2\frac{1}{2}$; 1; $2\frac{1}{4}$; $1\frac{1}{2}$; 2; $\frac{3}{4}$.

Complete to 4: $\frac{1}{4}$; $\frac{1}{2}$; $\frac{3}{4}$; etc.

Count by eighths to $2\frac{1}{2}$, beginning with $\frac{1}{8}$. Count backwards.

23. *Written Dictation.*

1. How long does it take the hour hand to pass from IX to XI?

Teacher write Roman numerals on the board.

2. Draw a circle and divide it so as to show that $\frac{1}{4}$ of it is equal to $\frac{2}{8}$ of it.

3. What part of a dollar must a boy earn in one day, that he may earn a whole dollar in 4 days?

4. If a boy earns $9 in 6 days, how much does he earn in 2 days?

5. At 40¢ a pound, how much will 4 ounces of coffee cost?

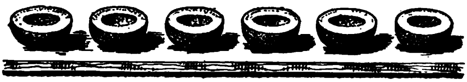
24. *Add both up and down — group for* 10 *where possible:*

8	497	855	893	925	485
6	613	757	767	982	694
4	524	972	175	368	418
7	285	348	932	998	883
5	895	863	678	116	237
5	652	641	548	884	798
2	356	439	261	256	549
8	734	675	889	967	958

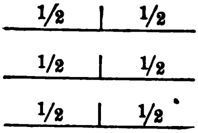
Make it your daily task to cultivate in each pupil the habit of checking all results. Be sure that the class knows several methods for checking sums: such as, breaking into shorter examples, by adding both ways, and by getting the answer of each column separately and combining at the end. While the correct result rather than speed should be the aim, the correct answer is most surely attained when the pupil adds at considerable speed.

25. *Reducing an Integer to an Improper Fraction. Dramatize. Give formal solution and diagram:*

1. *For study.* One morning Mrs. McCune took 3 cantaloupes from the icebox. After cutting them and removing the seeds, she placed one half of a cantaloupe on each plate at the table. How many people did she serve with cantaloupe?



Diagram



Analysis	Write
1 cantaloupe = $\frac{2}{2}$ cantaloupe. 3 cantaloupes = 3 × $\frac{2}{2}$ cantaloupe = $\frac{6}{2}$ cantaloupes.	3 c. = 3 × $\frac{2}{2}$ c. = $\frac{6}{2}$ c. Mrs. McCune served 6 people with cantaloupe.

The pupils should not undertake the diagram until they have had much practice in the more concrete forms of objective illustration, such as pictures, circles and rectangles. Make sure that they see the relation between the picture and the diagram, so that in future the diagram may speak an intelligible language. The class should not be held to the formal solution after they have mastered its logic.

2. How many half-peaches in 7 peaches?

3. Cut 5 pies into quarters. How many quarters?

4. Illustrate with squared paper how many:
   a. fourths there are in 3
   b. eighths in 2.
   c. halves in 6. Continue.

26. *Oral Problems.* 3 under

1. A lamp post 12 feet long is $\frac{1}{4}$ in the ground. How many feet are in the ground? What part is in the air? How many feet high does the post stand above the ground?

4 ÷ 8 [illegible] price

2. A dealer bought an Angora kitten for $8 and sold it for $\frac{1}{4}$ more than the cost price. What was the selling price?

3. Frank bought a pony for $75. He had it shod for $3 and kept it for a month at an expense of $12. He then sold it for $95. Did he gain or lose? How much?

Jan 31 da 4 ÷ 31

4. A family bought a quart of milk every day in January. How many gallons did they buy?

5. Thomas and William leave home on their wheels in the morning and travel in opposite directions. Thomas travels 12 miles and William 16. How far apart are they? If they return at the rate of 4 miles an hour, how long must Thomas wait until William gets home?

6. Our maid cut a cake into 12 pieces. She put $\frac{1}{2}$ the pieces upon the table, $\frac{1}{4}$ into lunch boxes and the rest into the cupboard. How many pieces in each place?

7. How many feet of picture molding will be required for a room 12 feet square?

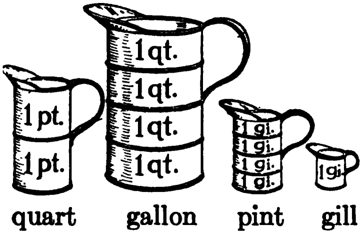
8. What is the gain on a bicycle that cost $32 and was sold for a gain of $\frac{1}{8}$ more?

9. The tire of a wheel measures 6 feet. How many revolutions will it make in going 12 yards?

10. A lake steamer left Milwaukee at 2 o'clock Tuesday afternoon and arrived at Manistee, Wednesday noon. How many hours had it been on the trip?

11. Marie cut a watermelon into 8 equal pieces and gave each of the 6 members of the family a piece. What part of the melon was eaten? Give the answer in two ways.

27. *Liquid Measure.*


1 pt.
1 pt.
1 qt.
1 qt.
1 qt.
1 qt.
1 gi.
1 gi.
1 gi.
1 gi.
1 gi.
quart
gallon
pint
gill

Complete and learn:

—— gills make 1 pint.
—— pints make 1 quart.
—— quarts make 1 gallon.

28. *At sight:*

1. 110 ÷ 11
88 ÷ 8
121 ÷ 11
66 ÷ 6
99 ÷ 11

2. 132 ÷ 12
35 ÷ 11
46 ÷ 4
92 ÷ 8
109 ÷ 11

3. 27 ÷ 11
58 ÷ 5
72 ÷ 11
90 ÷ 8
79 ÷ 7

4. 86 ÷ 11
47 ÷ 4
69 ÷ 6
60 ÷ 11
81 ÷ 7

29. *Multiply:*

1. 468 by $49\frac{1}{2}$
2. 476 by $78\frac{1}{4}$
3. 376 by $74\frac{1}{8}$
4. 396 by $83\frac{1}{4}$
5. 490 by $60\frac{1}{2}$
6. 738 by $83\frac{1}{6}$
7. 856 by $96\frac{1}{8}$
8. 744 by $59\frac{1}{2}$
9. 672 by $40\frac{1}{8}$
10. 756 by $86\frac{1}{4}$

30. *Complete and learn:*

a. 1 × 15 = 15
2 × 15 = 30
to
6 × 15 = 90

b. 90 ÷ 15 = 6
75 ÷ 15 = 5
to
15 ÷ 15 = 1

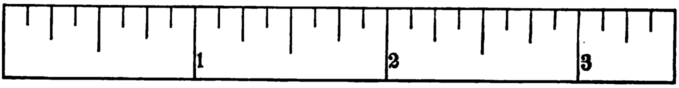
A fraction whose value is less than 1 is called a *proper fraction.* $\frac{3}{4}$ is a proper fraction.

A fraction whose value is equal to 1 or more than 1 is called an *improper fraction.* $\frac{5}{4}$ is an improper fraction.

A number composed of an integer and a fraction is called a *mixed number.* $5\frac{3}{4}$ is a mixed number.

The process of changing the form of any number without changing its value is *reduction.*

31.* *Change the following mixed numbers to improper fractions.* See p. 17 for introductory lesson.



1. *For study.*

$3\frac{3}{8}$ in. = $\frac{?}{8}$ in.

Analysis

1 in. = $\frac{8}{8}$ in.
3 in. = $3 \times \frac{8}{8}$ in. = $\frac{24}{8}$ in.
$3\frac{3}{8}$ in. = $\frac{24}{8}$ in. + $\frac{3}{8}$ in. = $\frac{27}{8}$ in.

Write

$3\frac{3}{8}$ in. = $\frac{24}{8}$ in. + $\frac{3}{8}$ in. = $\frac{27}{8}$ in.
$3\frac{3}{8}$ in. = $\frac{27}{8}$ in.

Change:

2. $2\frac{1}{4}$ to fourths.
3. $5\frac{1}{2}$ to halves.
4. $2\frac{1}{8}$ to eighths.
5. $2\frac{3}{4}$ to fourths.
6. $7\frac{1}{2}$ to halves.
7. $1\frac{5}{8}$ to eighths.

32. *Find the change due from* **$1** *if you make purchases amounting to:*

1. 10¢
2. 81¢
3. 26¢
4. 34¢
5. 42¢
6. 30¢
7. 23¢
8. 31¢
9. 71¢
10. 44¢
11. 27¢
12. 35¢
13. 33¢
14. 25¢
15. 32¢
16. 39¢
17. 24¢
18. 36¢
19. 49¢
20. 94¢

33. *Seeing Number All About Us.*

Make two original problems suggested by the picture above. Let one problem be of such difficulty as to require a pencil for its solution.

34.* *The Terms of a Fraction.*

1. In the fraction $\frac{5}{8}$ of a dollar, which figure shows that the dollar (the whole) has been divided? This figure is called the *denominator* of the fraction. What does the word "denomination" mean? Name several religious denominations.

2. In the fraction $\frac{5}{8}$ of a dollar, which figure shows how many of the equal parts of the whole have been taken? This figure is called the *numerator* of the fraction. What does it mean to "enumerate"? What is the school enumeration?

Complete and learn:

The denominator of the fraction tells into how many equal parts the whole has been divided and also gives the fraction its ——. It is the figure found below the line.

The numerator of a fraction tells how many of the equal parts of a whole have been taken. It is the figure found —— the line.

$219000 00

35. *Written Problems.*

1. A man lives $12\frac{1}{2}$ miles from his office. How many miles does he travel in going back and forth from Monday morning till Saturday night, if he does not go home for lunch?

2. A man is 56 years old and his wife is 48. Their son is $\frac{1}{4}$ as old as their combined ages. How old is the son?

3. A railroad company runs a train every 30 minutes from 6 A.M. to 6 P.M. How many trains run daily?

4. How many pounds of sugar at 10¢ a pound will equal in value 18 gallons of syrup at $1.00 a gallon?

5. What will 26 pecks of potatoes cost at 75 cents a peck?

6. Out of an estate of $500,000, Mr. Long left half to a hospital for the poor, $31,000 to a church and the rest to his widow. How much money did Mrs. Long receive?

7. If 200 desks which cost $16 each are sold for $20 each, how much is the gain? Two ways.

8. From a fish line $40\frac{3}{4}$ yards long, a piece 12 yards long was cut. How many yards were left?

9. What is due a laborer who works at $.90 an hour from 7 A.M. until 4 P.M. with one hour off at noon?

10. Albert weighs $83\frac{1}{2}$ pounds and Charles $73\frac{1}{2}$ pounds. How much do both boys weigh?

11. A farmer sold 45 bushels of potatoes. This was $\frac{1}{4}$ of all he had. How many bushels had he left? Drawing.

12. When a peck of apples is worth 75 cents, what is the price per pound? (15 lb. = 1 pk.)

13. When Mr. Mills repaired his house, he paid $240 for a new shingle roof and one half as much for a fresh coat of paint. How much was his entire bill?

14. A man owns 120 acres of land. One fourth is wooded. How many acres are wooded? The rest is meadow. What part is meadow? Draw a plan of this farm similar to the [illegible]an of Mr. Henderson's farm on page 9.

15. From a piece of goods containing $75\frac{5}{8}$ yards, $49\frac{3}{8}$ yards were cut. How many yards remained in the piece?

16. Find the sum of $\$10\frac{1}{4}$ $\$27\frac{1}{4}$; $\$6\frac{1}{4}$.

17. If a man carts away 860 loads of dirt at $1.50 a load, how much does he receive for his work?

18. If 75 cows are sold in one lot for $6000, what is the average price?

19. If a drain ditch 189 feet long is dug in the gutter of a street and 46 yards of it are filled in, how much more remains to be covered?

20. Mr. Simpson paid a debt of $290.85 and had $116.75 left. How much had he at first?

21. Counting 52 weeks in a year, how many years are there in 1820 weeks?

22. Jack raised 7 broods of 12 chickens each. One fourth of the chickens died. How many lived? What part of all the chickens lived?

23. Mr. Adams spent $\$201\frac{1}{2}$ on Monday, $\$38\frac{1}{4}$ on Tuesday, $\$32\frac{1}{4}$ on Wednesday. Change these amounts to dollars and cents and find how much he spent during the three days.

24. Sweet potatoes weigh 55 pounds to the bushel. How many bushels can be put into a car whose capacity is 38,500 pounds?

25. During the month of February, Mr. Smith realized $240 from his rentals. During March, he realized $\frac{1}{4}$ more than in February. How much did he realize during March?

26. The product of two numbers is 205,020. One of the numbers is 67. What is the other?

27. A steam shovel excavated 91,200 cubic yards of earth in 48 days. How many cubic yards did it excavate per day?

36. *Subtract without pencil:*

1. $58 - 26 = 32$

Think: $\begin{cases} 58 - 20 = 38 \\ 38 - 6 \ \ = 32 \end{cases}$ Say: 38, 32.

2. $\begin{array}{r} 68 \\ \underline{34} \end{array}$

3. $\begin{array}{r} 89 \\ \underline{56} \end{array}$

4. $\begin{array}{r} 76 \\ \underline{25} \end{array}$

5. $\begin{array}{r} 87 \\ \underline{42} \end{array}$

For those classes using the Austrian method the process is:

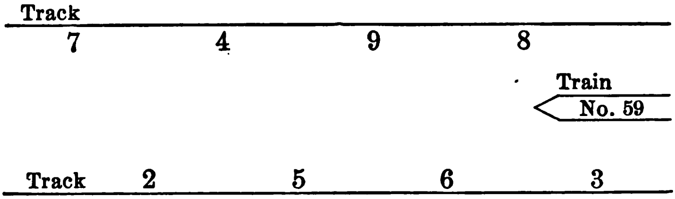
$$20 + 38 = 58$$
$$6 + 32 = 38$$

37. *Reduce to improper fractions* (*without pencil*):

1. $6\frac{1}{4}$, $5\frac{1}{2}$, $2\frac{1}{8}$
2. $7\frac{1}{2}$, $3\frac{5}{8}$, $9\frac{3}{4}$
3. $2\frac{7}{8}$, $5\frac{3}{4}$, $4\frac{5}{8}$
4. $6\frac{3}{4}$, $8\frac{1}{2}$, $4\frac{3}{8}$

When pupils hesitate in giving answers, require the form found on page 20.

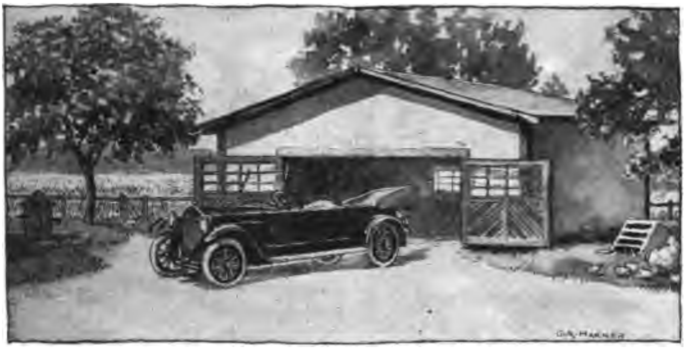
38. *A Railroad Trip from New York to Chicago. A Game.*



Each number on the side lines represents a station. As the train (No. 59) arrives at each station, the brakeman calls out the name, which is the sum of 59 and the number which represents the station (the several digits respectively). The brakeman loses his place should he fail to call the answers correctly or make the trip in the time allotted by the teacher. This time allotment should decrease as rapidly as the class shows strength. Accuracy is the first requisite. Change the number on the train with each trip. This game is of equal service in the review of subtraction, multiplication and division.

39. *Meadowbrook Farm: III — The New Garage.*

Reducing an Improper Fraction to an Integer or Mixed Number.



1. Mr. Henderson bought a new automobile and built the garage which you see in the picture. Construct a model of his garage from stiff paper, using $\frac{1}{4}$ inch to represent 1 foot of the garage.

The Henderson Garage.	Your Model.
Length = 32 ft.	Length = $\frac{32}{4}$ inches = — in.
Depth = 18 ft.	Depth = $\frac{18}{4}$ inches = — in.
Side Height = 12 ft.	S. H. = $\frac{12}{4}$ inches = — in.
Center Height = 16 ft.	C. H. = $\frac{16}{4}$ inches = — in.
Roof = 38 ft. × 22 ft.	Roof = $\frac{38}{4} \times \frac{22}{4}$ inches = — in.
Double Doors = 18 ft. × 8 ft.	D. D. = ?
Windows = 3 ft. × 7 ft.	W. = ?

If the program does not permit of the construction of the model during school hours ask the pupils to do the work at home. As preparation for this, show them a paper model constructed to scale and have them compute the correct dimensions. The pupils will probably find it more interesting to make a model of some garage in the neighborhood of the school, and in such case the social significance of what is usually considered merely a mechanical process will be more fully realized.

40.* *Reducing an Improper Fraction (continued).*

See pp. 17, 20, and 25 for previous lessons.

1. *For study.* How many pound-boxes of butter will be required to hold 12 quarter-pound packages?

Solution

$\frac{4}{4}$ lb. = 1 lb.
$\frac{12}{4}$ lb. ÷ $\frac{4}{4}$ lb. = 3 times.
$\frac{12}{4}$ lb. = 3 lb.

Three pound-boxes of butter will be required.

2. One can of peaches contains 14 half-peaches. How many whole peaches are there in the can?

3. There were 25 pupils in the graduating class, each of whom wore a ribbon badge $\frac{1}{4}$ of a yard long. How much ribbon was required for all the badges?

4. A confectioner sold 9 boxes of candy, each of which contained 4 ounces or $\frac{1}{4}$ pound of candy. How many pounds of candy did he sell in all?

5. In a milk wagon was a crate containing 25 pint bottles of cream. How many gallons of cream did it take to fill the bottles?

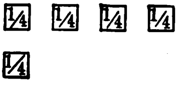
6. A farmer sold $\frac{1}{4}$ of a bushel of tomatoes to each of 12 customers. How many bushels did he sell?

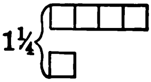
7. There were 1,264 people who attended the circus one afternoon. If each paid $\$\frac{1}{2}$, how much were the gate receipts?

8. $\frac{7}{2}$
9. $\frac{9}{4}$
10. $\frac{11}{8}$
11. $\frac{15}{4}$
12. $\frac{19}{8}$
13. $\frac{11}{2}$
14. $\frac{13}{2}$
15. $\frac{17}{4}$
16. $\frac{21}{8}$

Illustrate any of the above, with squared paper or by drawing:

For example: $\frac{5}{4} = 1\frac{1}{4}$





41. *a. Reduce to whole or mixed numbers at sight:*

1. $\frac{16}{2}$ $\frac{7}{4}$ $\frac{9}{8}$	**2.** $\frac{5}{4}$ $\frac{5}{2}$ $\frac{18}{8}$	**3.** $\frac{15}{8}$ $\frac{17}{4}$ $\frac{15}{2}$	**4.** $\frac{19}{2}$ $\frac{14}{8}$ $\frac{23}{4}$

b. Reduce to improper fractions:

1. $3\frac{1}{2}$ $7\frac{1}{4}$ $4\frac{3}{8}$	**2.** $6\frac{3}{4}$ $3\frac{1}{8}$ $6\frac{1}{2}$	**3.** $3\frac{5}{8}$ $7\frac{3}{4}$ $9\frac{1}{2}$	**4.** $7\frac{1}{2}$ $6\frac{7}{8}$ $3\frac{3}{8}$

42. *Oral Problems.*

1. Add without pencil: $\begin{array}{r}46\\ \underline{35}\end{array}$

Think: $\left\{\begin{array}{l}46+30=76\\ 76+\ \ 5=81\end{array}\right.$

Say: 76, 81.

2. $\begin{array}{r}29\\ \underline{56}\end{array}$	**5.** $\begin{array}{r}45\\ \underline{19}\end{array}$	**8.** $\begin{array}{r}27\\ \underline{96}\end{array}$
3. $\begin{array}{r}78\\ \underline{17}\end{array}$	**6.** $\begin{array}{r}63\\ \underline{28}\end{array}$	**9.** $\begin{array}{r}49\\ \underline{35}\end{array}$
4. $\begin{array}{r}24\\ \underline{67}\end{array}$	**7.** $\begin{array}{r}58\\ \underline{19}\end{array}$	**10.** $\begin{array}{r}87\\ \underline{56}\end{array}$

43. *Subtract at sight:*

1. $\begin{array}{r}45{,}706\\ \underline{26{,}839}\end{array}$	**4.** $\begin{array}{r}96{,}068\\ \underline{48{,}587}\end{array}$	**7.** $\begin{array}{r}45{,}345\\ \underline{38{,}767}\end{array}$	**10.** $\begin{array}{r}87{,}569\\ \underline{69{,}876}\end{array}$
2. $\begin{array}{r}34{,}563\\ \underline{29{,}564}\end{array}$	**5.** $\begin{array}{r}34{,}854\\ \underline{15{,}959}\end{array}$	**8.** $\begin{array}{r}34{,}945\\ \underline{18{,}946}\end{array}$	**11.** $\begin{array}{r}95{,}634\\ \underline{56{,}896}\end{array}$
3. $\begin{array}{r}42{,}432\\ \underline{27{,}589}\end{array}$	**6.** $\begin{array}{r}35{,}954\\ \underline{29{,}967}\end{array}$	**9.** $\begin{array}{r}62{,}676\\ \underline{56{,}979}\end{array}$	**12.** $\begin{array}{r}93{,}646\\ \underline{87{,}878}\end{array}$

44. *Written Dictation.*

1. Write an improper fraction equal to $2\frac{3}{8}$.

2. Write a proper fraction whose denominator is 8.

3. A box containing 1 dozen cakes of toilet soap is sold for \$2.40. How much are 4 of the cakes worth?

4. Write 3 quarts as a fraction of a gallon.

5. Draw a line 6 inches long. Mark off $\frac{1}{4}$ of it. How long is $\frac{1}{4}$ of 6 inches?

45. *Meadowbrook Farm: IV — The Automobile. Oral.*

1. Mr. Henderson made a driveway to his garage. He paid \$96 for labor and $\frac{1}{4}$ of that amount for gravel. What was the whole cost?

2. Mr. Henderson paid a laborer \$$2\frac{1}{4}$ a sq. yd. for cementing the floor of his garage. There were 60 square yards in the floor. What was the amount of the bill?

3. On their first trip the family traveled 60 miles before dinner and $\frac{1}{2}$ of that distance after dinner. What was the length of the trip?

4. If they made the whole journey in 6 hours, what was their average speed per hour?

5. On the trip the automobile used 9 gallons of gasoline. At 25¢ a gallon what was the cost of the gasoline for each of the five passengers?

6. During the year Mr. Henderson paid \$30.75 for repairing tires, and at the end of the year \$120 for new tires. What was his entire bill?

7. A new horn cost \$3.75 and a new lamp \$1.25. What was the amount of that bill?

8. The first month, Mr. Henderson drove 500 miles; the second month, 356 miles. How much farther did he drive the first month than he did the second?

9. He drew 24 gallons from his gasoline tank in one week. This was 4 gallons less than the amount that remained in the tank. How many gallons were in the tank at first?

10. Mr. Henderson paid \$1200 for his machine. At the end of the second year he bought a new automobile worth $\frac{1}{4}$ more than the other. He paid \$800 cash and traded in the old car. What did he receive for the old automobile?

11. Imagine yourself a member of the Henderson family, on a trip to the seashore or mountains. Make an original problem that the class can solve without pencil.

46. *Finding the Value of a Part when that of the Whole is Given — Integers.*

1. *For study.* A man owned a drove of 12 sheep worth $144. He sold 5 of them. How much did he receive for the sheep he sold?

Diagram	Analysis
12 sheep = $144	12 sheep = $144
------------	1 sheep = $144 ÷ 12 = $12
5 sheep = ?	5 sheep = 5 × $12 = $60

He received $60 for the sheep he sold.

2. A pat of butter weighing 3 pounds cost $1.80. What is the cost of 2 pounds?

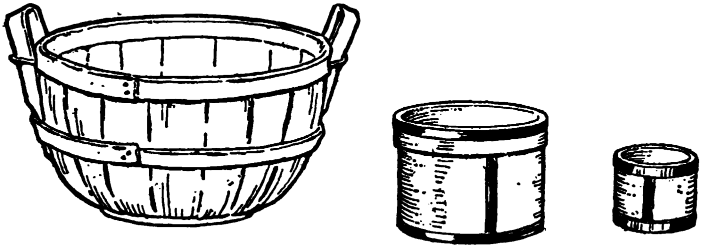
3. When 9 barrels of flour cost $63, what is the cost of 7 barrels?

4. Four dozen eggs cost $1.60. How much will 3 dozen cost?

5. When 5 gallons of syrup cost $4, what is the cost of 3 gallons?

Continue this type of exercise until the class as a whole grasps the idea of "unitary analysis." This exercise is preparatory to Exercise 53 on page 35.

47. *Dry Measure.*



Complete and learn:

—— pints make 1 quart.
—— quarts make 1 peck.
—— pecks make 1 bushel.

48. *Oral Exercises.*

1. *Add:*

46	54	37	65	47	39	64
35	29	14	27	36	25	38

2. If 12 books can be bought for $30, how many similar books can be bought for $15? How much will 4 such books cost?

3. Roy gained 8 pounds last year. He now weighs 71 pounds. How much did he weigh a year ago?

4. I bought 6 pineapples at 20¢ each. How much change did I receive from a two-dollar bill? Count the change as a dealer would count it to you.

5. A confectioner sold 9 boxes of candy, each of which contained $\frac{1}{4}$ of a pound of candy. How many pounds did he sell in all?

6. Mrs. Adams divided $1.90 equally between Roy and James. How much did each boy receive?

7. One Saturday, a baker used $6\frac{1}{2}$ dozen eggs in baking cakes. How many cakes did he bake if he used $\frac{1}{2}$ dozen in each?

8. A grocer buys pepper at 60¢ a pound and sells it at 80¢. How much does he make on $3\frac{1}{2}$ pounds?

9. Ralph gave away 16 marbles and had 8 marbles left. What part of all his marbles did he give away?

10. At 20 miles an hour, how long will it take a freight train to go 70 miles?

11. Cantaloupes at 2 for 25¢ are how much a dozen?

12. Fifteen people were served at dinner with $\frac{1}{4}$ of a pie each. How many pies were cut? How much was left?

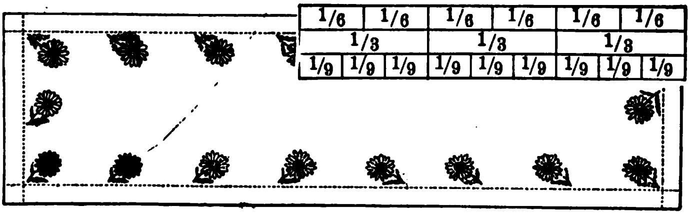
13. A charity organization obtained $8\frac{3}{4}$ tons of coal which it gave in quarter-ton loads to poor families. How many families were helped?

14. Make an original problem about a circus parade.

49. *Comparison of Thirds, Sixths and Ninths.*

1. Miss French embroidered a lunch cloth with a daisy chain in which there were 18 daisies placed at regular intervals. The first day she outlined $\frac{1}{3}$ of all the daisies, added leaves to $\frac{1}{6}$ of the whole number and finished $\frac{1}{9}$.

a. How many of the daisies were outlined?
b. How many of the daisies had the leaves added?
c. How many of the daisies were entirely finished?



2. *Complete:*
$1=\frac{?}{3}$
$1=\frac{?}{6}$
$1=\frac{?}{9}$

$\frac{1}{3}=\frac{?}{6}$
$\frac{2}{3}=\frac{?}{6}$
$\frac{3}{3}=\frac{?}{6}$

$\frac{1}{3}=\frac{?}{9}$
$\frac{2}{3}=\frac{?}{9}$
$\frac{3}{3}=\frac{?}{9}$

50. *a. Reduce to improper fractions:*

1. $12\frac{1}{3}$
$15\frac{1}{6}$
$14\frac{2}{9}$
$13\frac{5}{6}$

2. $16\frac{3}{8}$
$23\frac{5}{9}$
$17\frac{1}{3}$
$24\frac{3}{8}$

3. $14\frac{7}{8}$
$27\frac{3}{4}$
$16\frac{8}{9}$
$19\frac{3}{4}$

4. $13\frac{3}{5}$
$27\frac{5}{7}$
$17\frac{2}{3}$
$35\frac{2}{3}$

Pupils who fail should be required to give the form found in Exercise 31, page 20.

b. Reduce to whole or to mixed numbers:

1. $\frac{72}{4}$
$\frac{53}{8}$
$\frac{47}{9}$
$\frac{96}{7}$
$\frac{57}{6}$

2. $\frac{25}{7}$
$\frac{31}{2}$
$\frac{52}{8}$
$\frac{84}{9}$
$\frac{69}{4}$

3. $\frac{71}{9}$
$\frac{51}{4}$
$\frac{83}{5}$
$\frac{36}{5}$
$\frac{61}{3}$

4. $\frac{18}{5}$
$\frac{47}{6}$
$\frac{62}{7}$
$\frac{49}{8}$
$\frac{93}{7}$

Pupils who fail should be required to give the form found in Exercise 40, page 26.

51. *Written Problems.* 6 x 46

1. A grocer bought 46 bushels of potatoes. This was $\frac{1}{6}$ of a carload. How many bushels in the car?

2. The price of pineapples per crate was \$6$\frac{1}{2}$ in season and \$10$\frac{3}{4}$ at Christmas. How much had the price advanced at Christmas? then by

3. How much will 24 barrels of flour cost at the rate of \$36 for 3 barrels? Two ways.

mul 4 x 42

4. If a barrel of turpentine contains 42 gallons, how many gallons are there in 4$\frac{1}{6}$ barrels?

5500

5. If $\frac{1}{4}$ of a mill is worth \$5500, how much is $\frac{1}{8}$ of it worth? How much is $\frac{1}{2}$ of it worth? Drawing.

6. A certain freight train carried 678 barrels of meat. Each barrel weighed on the average 360 pounds. Find the total weight.

7. It took a steam locomotive 3$\frac{3}{5}$ minutes and an electric locomotive 2$\frac{1}{5}$ minutes to attain the speed of 40 miles an hour. How much more quickly did the latter attain that speed?

8. The subtrahend is 468$\frac{5}{9}$; the difference is 512$\frac{2}{9}$. What is the minuend?

9. A real estate dealer bought 12$\frac{1}{4}$ acres of pasture at [illegible]20 an acre. How much did he pay for it?

10. How many feet of fence will be needed for a garden 26$\frac{1}{4}$ feet square?

11. In a sack of money were 175 quarter-dollars. What is the value of the money in the sack?

12. How many minutes in 3$\frac{1}{4}$ hours?

13. If vacation begins June 12 and ends September 12, how many days long is it? Count both days in your reckoning.

14. The post office is 320 rods or 1 mile from the school house. How many feet is it from the school house?

60437

15. Samuel rode $48\frac{1}{8}$ miles on his wheel on Monday. The next day he rode $65\frac{5}{8}$ miles. How far did he ride during the two days?

16. How much must be paid for 56 pounds of butter at $62\frac{1}{2}$¢ a pound?

17. A salesman sold $26\frac{1}{4}$ yards of goods to one customer and $17\frac{3}{4}$ yards to another. How many yards did he sell to both?

18. From a bolt of cloth containing $36\frac{3}{4}$ yards he sold $18\frac{1}{4}$ yards. How many yards remained in the piece?

19. A fruit peddler bought a box containing 4 dozen oranges for $1.60. He sold the oranges so as to gain 2 cents on each orange. How much did he receive for them? Two ways.

20. At a Christmas celebration 156 stockings filled with candy were distributed. If there was a quarter of a pound of candy in each stocking, how much did all the candy weigh?

21. If one man can dig a trench in 12 days, how long will it take 4 men to dig the trench?

22. After selling $2\frac{3}{8}$ yards of hat lining, the clerk measured the remainder of the piece. It was $10\frac{5}{8}$ yards long. What had been the original length of the piece?

23. A merchant bought $3\frac{1}{2}$ dozen neckties at 75¢ each. How much did he pay for them?

24. At the rate of 3 pounds of sugar for 50¢, how many pounds can be bought for $6.50?

25. In making a journey of 1932 miles, a man traveled $\frac{1}{4}$ of the distance on water. How many miles did he travel on land?

26. A piece of crash 29 inches long was made into a towel. If each hem required $1\frac{1}{2}$ inches of the crash, how long was the towel?

27. After selling $64\frac{1}{4}$ acres, Mr. Thompson still owns $56\frac{3}{4}$ acres of land. How many acres did he own at first?

28. If 1 match in 19 breaks in striking, how many are broken in striking 13,452 matches?

29. A box of soap weighed 30$\frac{3}{8}$ pounds. The box itself weighed 2$\frac{1}{8}$ pounds. How much did the soap weigh?

30. Jack's kite string broke at a distance of 136$\frac{1}{4}$ feet from his hand. The piece attached to the kite was 245$\frac{3}{4}$ feet long. What was the length of the entire string?

31. If $\frac{5}{8}$ of the walls of a building are made of common brick, $\frac{1}{8}$ of pressed brick, and the remainder of stone, what part of the walls is made of stone?

32. At $8 a ton, what must I pay for 19$\frac{1}{2}$ tons of coal?

33. What is the difference between the cost of 6 bushels of potatoes when they are 3¢ a lb. and when they are 5¢ a lb.? 60 lb. = 1 bu.

34. A school room was equipped with 42 school desks costing $6 each. The freight charges were $17 and the expense of placing them in the room was $7. What was the final cost of the desks?

52. *Comparison of Halves, Thirds, Fourths, Sixths and Twelfths.*

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</table>

Complete and learn:

$1 = \frac{?}{12}$
$\frac{1}{2} = \frac{?}{12}$
$\frac{2}{2} = \frac{?}{12}$

$\frac{1}{3} = \frac{?}{12}$
$\frac{2}{3} = \frac{?}{12}$
$\frac{3}{3} = \frac{?}{12}$

$\frac{1}{4} = \frac{?}{12}$
to
$\frac{4}{4} = \frac{?}{12}$

$\frac{1}{6} = \frac{?}{12}$
to
$\frac{6}{6} = \frac{?}{12}$

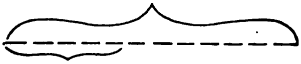
53. *Finding the Value of the Part when that of the Whole is Given — Fractions.*

1. *For study.*

a. A man owned a drove of 12 sheep worth $144. He sold 5 of them. How much did he receive for the sheep he sold?

Solution by Integers.

12 sheep = $144



5 sheep = ?

Analysis

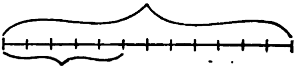
12 sheep = $144
1 sheep = $144 ÷ 12 = $12
5 sheep = 5 × $12 = $60

He received $60 for the 5 sheep.

b. A man owned a drove of sheep worth $144. He sold $\frac{5}{12}$ of his drove. How much did he receive?

Solution by Fractions.

$\frac{12}{12}$ or the drove = $144



$\frac{5}{12}$ of drove = ?

Analysis

$\frac{12}{12}$ of the drove = $144
$\frac{1}{12}$ of the drove = $144 ÷ 12 = $12
$\frac{5}{12}$ of the drove = 5 × $12 = $60

He received $60 for $\frac{5}{12}$ of the drove.

2. A pat of butter weighing 3 pounds cost 90 cents. What is the cost of 2 pounds ($\frac{2}{3}$ of the pat)?

3. I had 28 chocolate caramels. I gave $\frac{6}{7}$ of them away. How many pieces had I left?

4. Robert had 32 marbles. Frank had $\frac{3}{8}$ as many. How many marbles had Frank?

5. There were 20 cookies on the plate at supper time. After supper only $\frac{1}{4}$ of them were left. How many cookies had we eaten?

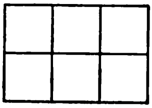
6. A paper hanger worked 8 hours one day. Three fourths of the time he had a helper. How long did the helper work?

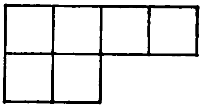
Continue this type of exercise daily until the class can readily diagram and analyze any problem of this type. Do not increase the difficulty of the problems for the present.

54. *Suggestive Questions in Fractions.*

See pp. 12 and 13 for previous lessons.

1. With squared paper, make three different fractions, using irregular as well as regular figures. For example, either of these figures makes $\frac{6}{8}$.





2. Collect 18 books. Place them in two piles with $\frac{5}{9}$ of the books in one pile. How many books are in the second pile?

3. Illustrate as in 2, the fractions $\frac{5}{6}$, $\frac{3}{4}$, $\frac{2}{3}$, $\frac{7}{8}$ by using other objects found in your school room, in your kitchen, at home or on the street.

4. Name five things that can be written as integers and as fractions. For example: 75 cents = \$$\frac{3}{4}$; 1 pint = $\frac{1}{8}$ gallon.

5. Write $\frac{3}{4}$. Write another fraction with parts $\frac{1}{2}$ as large and having the same numerator. What is the second fraction?

6. Write $\frac{1}{4}$. Write another fraction with twice as many parts of the same size. How does it compare in value with the first fraction?

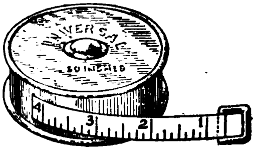
7. How much less than 1 are: $\frac{3}{8}$; $\frac{7}{9}$; $\frac{3}{5}$; $\frac{4}{7}$?

8. How much greater than 1 are: $\frac{5}{4}$; $\frac{11}{8}$; $\frac{15}{12}$; $\frac{11}{9}$; $\frac{7}{3}$?

55. *Linear Measure.*

Complete and learn:

—— inches make 1 foot.
—— feet make 1 yard.
—— feet make 1 rod.
—— rods make 1 mile.
—— feet make 1 mile.



56. *Complete and learn:*

a. $1 \times 12 = 12$
$2 \times 12 = 24$
to
$12 \times 12 = 144$

b. $144 \div 12 = 12$
$132 \div 12 = 11$
to
$12 \div 12 = 1$

57. *Written Dictation.*

1. Write a mixed number equivalent to $\frac{17}{5}$.

2. Write an improper fraction equivalent to $3\frac{5}{7}$.

3. Three pints are what part of a gallon?

4. A man owned $\frac{2}{3}$ of a mill and sold $\frac{1}{2}$ of his share. What part of the mill did he sell?

5. A woman who owned 36 hens set $\frac{1}{3}$ of them. How many hens were left?

58. *Find quotient:*

1. $588,489 \div 189$
2. $126,927 \div 179$
3. $129,410 \div 168$
4. $115,247 \div 189$
5. $139,178 \div 197$
6. $955,650 \div 157$

Do not permit the use of the pencil in obtaining trial divisors. Teach pupils to estimate in round numbers, as:

$$614,489 \div 189 = 600,000 \div 200$$

59. *Find the sum:*

1.	**2.**	**3.**	**4.**	**5.**	**6.**
876	659	489	897	959	985
682	561	658	426	768	556
558	968	348	697	984	796
173	498	579	898	884	427
957	846	942	932	626	784
557	542	748	953	838	789
673	543	363	665	198	548
844	828	946	677	732	574
779	585	679	963	979	967
869	896	978	896	865	687

2/3
1/2

2
3 × 1/3

60.* *Addition of Like Fractions. Dramatize.*

Solve with integers and fractions.

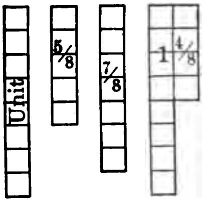
1. *For study.* Mrs. Munson made 3 quarts ($\frac{3}{4}$ gallon) of apple butter on Monday and 3 quarts on Tuesday. She put the butter into gallon jars. How many gallons of apple butter had she made?

Solution by Integers	Solution by Fractions
3 quarts	$\frac{3}{4}$ gallon
1 quart + 2 quarts	$\frac{1}{4}$ gallon + $\frac{2}{4}$ gallon
1 gallon + 2 quarts	1 gallon + $\frac{2}{4}$ gallon ($\frac{1}{2}$ gal.)

Mrs. Munson made 1 gallon 2 quarts ($1\frac{1}{2}$ gallons) of apple butter.

2. It required $\frac{5}{8}$ of a yard of silk to make one doll dress and $\frac{7}{8}$ of a yard to make another. How many yards were required in all?

For study. $\frac{5}{8}$ yd. + $\frac{7}{8}$ yd. = $\frac{5+7}{8}$ yd. = $\frac{12}{8}$ yd. = $1\frac{1}{2}$ yd.



$\frac{5}{8} + \frac{7}{8} = \frac{12}{8} = 1\frac{1}{2}$.

Fix thoroughly that in integers, 10 is the constant unit and that in common fractions, the unit is the same as the denominator. In addition of fractions, the numerators are added according to the decimal system and the sum becomes the numerator of a common fraction subject to division by the common denominator. A thorough understanding of this initial step will be a great help when later in the subtraction of mixed numbers the pupil reaches that very difficult point where the fraction in the subtrahend exceeds that in the minuend.

3. A farmer gave $\frac{5}{8}$ of a bushel of cut feed to two horses and $\frac{3}{8}$ of a bushel to a third horse. How much did all three horses receive?

4. $\frac{6}{7} + \frac{5}{7}$

5. $\frac{5}{9} + \frac{8}{9}$

6. $\frac{7}{10} + \frac{9}{10}$

7. $\frac{8}{12} + \frac{9}{12}$

8. $\frac{6}{8} + \frac{7}{8}$

9. $\frac{7}{11} + \frac{8}{11}$

10. $\frac{5}{11} + \frac{9}{11}$

11. $\frac{9}{13} + \frac{7}{13}$

12. $\frac{9}{15} + \frac{8}{15}$

61. *Mr. Johnson's Restaurant: III — Oral.*

A birthday dinner was given in the private dining room one day.

a. What was the cost of each course?
b. Of the whole dinner?

First Course

$1\frac{1}{2}$ quarts of tomato soup @ 20¢ qt.
$\frac{1}{4}$ lb. of wafers @ 32¢ lb.
2 bunches of celery @ $12\frac{1}{2}$¢ each
1 pt. olives @ 60¢ a quart

Second Course

$7\frac{1}{2}$ lb. chicken @ 50¢ lb.
$\frac{1}{4}$ pk. potatoes @ 60¢ pk.
2 cans peas @ $22\frac{1}{2}$¢ can
1 glass jelly @ 30¢
2 pans rolls @ 15¢ pan
$\frac{3}{8}$ lb. butter @ 64¢ lb.

Third Course

4 grape fruit @ $12\frac{1}{2}$¢ each
$\frac{1}{2}$ lb. lettuce @ 20¢ lb.
$\frac{1}{4}$ lb. cheese wafers @ 36¢ lb.
$\frac{1}{4}$ lb. nuts @ $1 lb.

Fourth Course

$\frac{1}{2}$ gal. ice cream @ $2.40 gal.
$2\frac{1}{2}$ lb. white cake @ 50¢ lb.
8 cups coffee @ $2\frac{1}{2}$¢ cup
Allow $$1\frac{1}{2}$ for a bunch of roses; and 15¢ for salt, sugar and olive oil.

62. *Addition of Mixed Numbers.*

1. *For study.* $5\frac{3}{4} + 7\frac{3}{4} = ?$

$$\begin{array}{r|l} 5\frac{3}{4} & 3 \\ 7\frac{3}{4} & 3 \\ \hline 12 & \frac{6}{4} \text{ or } 1\frac{1}{2} \end{array}$$

$$12 + 1\frac{1}{2} = 13\frac{1}{2}$$

Make sure that pupils understand why the denominator 4 is omitted in the addends to the right of the vertical line.

2. $\begin{array}{r} 5\frac{4}{7} \\ \underline{8\frac{6}{7}} \end{array}$

3. $\begin{array}{r} 4\frac{7}{8} \\ \underline{7\frac{5}{8}} \end{array}$

4. $\begin{array}{r} 7\frac{5}{9} \\ \underline{8\frac{7}{9}} \end{array}$

5. $\begin{array}{r} 6\frac{3}{11} \\ \underline{8\frac{9}{11}} \end{array}$

6. $\begin{array}{r} 7\frac{5}{6} \\ \underline{9\frac{3}{6}} \end{array}$

7. $\begin{array}{r} 6\frac{4}{5} \\ \underline{5\frac{2}{5}} \end{array}$

8. $\begin{array}{r} 6\frac{8}{9} \\ \underline{7\frac{4}{9}} \end{array}$

9. $\begin{array}{r} 8\frac{7}{12} \\ \underline{6\frac{5}{12}} \end{array}$

10. $\begin{array}{r} 9\frac{5}{6} \\ \underline{6\frac{1}{6}} \end{array}$

11. $\begin{array}{r} 9\frac{4}{5} \\ \underline{7\frac{3}{5}} \end{array}$

12. $\begin{array}{r} 5\frac{7}{10} \\ \underline{8\frac{5}{10}} \end{array}$

13. $\begin{array}{r} 4\frac{5}{7} \\ \underline{9\frac{4}{7}} \end{array}$

14. $\begin{array}{r} 35\frac{5}{8} \\ \underline{17\frac{7}{8}} \end{array}$

15. $\begin{array}{r} 47\frac{5}{6} \\ \underline{23\frac{1}{6}} \end{array}$

16. $\begin{array}{r} 46\frac{7}{9} \\ \underline{98\frac{5}{9}} \end{array}$

17. $\begin{array}{r} 54\frac{2}{3} \\ \underline{79\frac{2}{3}} \end{array}$

18. $\begin{array}{r} 92\frac{4}{5} \\ \underline{69\frac{3}{5}} \end{array}$

19. $\begin{array}{r} 37\frac{3}{4} \\ \underline{59\frac{3}{4}} \end{array}$

63. *At sight:*

1. $37 \div 11$
$70 \div 15$
$132 \div 12$
$47 \div 11$

2. $92 \div 15$
$72 \div 11$
$90 \div 12$
$85 \div 15$

3. $49 \div 12$
$65 \div 15$
$121 \div 11$
$108 \div 12$

4. $98 \div 12$
$80 \div 11$
$78 \div 15$
$56 \div 12$

64. *Complete:*

1. $\frac{1}{2} = \frac{?}{4};\ \frac{?}{6};\ \frac{?}{8};\ \frac{?}{12}.$
2. $\frac{1}{3} = \frac{?}{6};\ \frac{?}{9};\ \frac{?}{12};\ \frac{?}{15}.$
3. $\frac{2}{3} = \frac{?}{6};\ \frac{?}{9};\ \frac{?}{12};\ \frac{?}{15}.$
4. $\frac{1}{4} = \frac{?}{8};\ \frac{?}{12};\ \frac{?}{16};\ \frac{?}{20}.$
5. $\frac{3}{4} = \frac{?}{8};\ \frac{?}{12};\ \frac{?}{16};\ \frac{?}{20}.$

Demonstrate by drawing or cutting when pupils hesitate. Return to the exercise until the pupils can give the answers automatically.

65. *Find sum:*

1. $87\frac{5}{8}$
$\underline{69\frac{7}{8}}$

2. $38\frac{4}{5}$
$\underline{27\frac{3}{5}}$

3. $49\frac{11}{12}$
$\underline{88\frac{7}{12}}$

4. $58\frac{5}{6}$
$\underline{65\frac{2}{6}}$

5. $97\frac{7}{10}$
$\underline{69\frac{9}{10}}$

6. $57\frac{4}{9}$
$\underline{68\frac{7}{9}}$

7. $57\frac{8}{13}$
$\underline{64\frac{9}{13}}$

8. $65\frac{4}{7}$
$\underline{49\frac{6}{7}}$

9. $36\frac{6}{7}$
$\underline{47\frac{5}{7}}$

10. $46\frac{2}{9}$
$\underline{78\frac{8}{9}}$

11. $56\frac{7}{11}$
$\underline{39\frac{9}{11}}$

12. $38\frac{9}{14}$
$\underline{56\frac{11}{14}}$

66. *Toss Ball — A Game*

Form the children into a circle. Give to each a card upon which is written a mixed number (or fraction). Stand outside the circle holding a large rubber ball in the hand. Announce the combination as "$2\frac{1}{4} + 1\frac{1}{4}$," give the pupils a reasonable time to get the answer, and then toss the ball into the center of the circle. The child who holds the card upon which is written $3\frac{1}{2}$ should catch the ball and toss it back to the teacher. If a child fails to respond to his number he goes to the center until he has a chance to redeem himself. This game can be adapted to the other fundamental processes.

67.* *Addition of Unlike Fractions.*

Solve by integers and by fractions:

1. *For study.* Mary made 12 ounces ($\frac{3}{4}$ lb.) of pink candy and 8 ounces ($\frac{1}{2}$ lb.) of white candy. How much did all her candy weigh?

Solution by Integers	Solution by Fractions
12 oz. pink	$\frac{1}{2}$ lb. = $\frac{2}{4}$ lb. white
8 oz. white	$\frac{3}{4}$ lb. = $\frac{3}{4}$ lb. pink
20 oz. or 1 lb. 4 oz.	$\frac{5}{4}$ lb. or $1\frac{1}{4}$ lb.
Mary made 1 lb. 4 oz. of candy	Mary made $1\frac{1}{4}$ lb. of candy

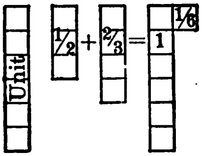
2. Robert had ridden $\frac{5}{8}$ of a mile or 200 rods on his wheel when his tire was punctured. After mending it, he rode $\frac{3}{4}$ of a mile or 240 rods farther. Length of his trip?

3. Mrs. Hunter used 3 pints of milk in getting lunch and $1\frac{1}{2}$ quarts at dinner. How much milk did she use in all?

4. A train reached Southport in 45 minutes. Thirty minutes later it reached Palmerton. How much time did it take a passenger to reach Palmerton?

5. Mr. Ayres planted $\frac{1}{2}$ of an acre in corn, and $\frac{2}{3}$ of an acre in potatoes. How much land did he plant?

For study. $\frac{1}{2} + \frac{2}{3} = 1\frac{1}{6}$.



6. $\frac{2}{3} + \frac{3}{4} = ?$
7. $\frac{5}{6} + \frac{1}{3} = ?$
8. $\frac{1}{3} + \frac{5}{9} = ?$
9. $\frac{7}{8} + \frac{1}{4} = ?$
10. $\frac{1}{3} + \frac{5}{9} = ?$
11. $\frac{5}{8} + \frac{1}{2} = ?$
12. $\frac{2}{3} + \frac{1}{9} = ?$
13. $\frac{1}{6} + \frac{2}{3} = ?$

> *Complete and learn:*
>
> Numbers of the same denomination are called "like numbers." Only —— —— can be added or subtracted.

sub – 3⅛ from

68. *Written Problems.*

1. A box of scouring brick weighed 48⅝ pounds. The weight of the box itself was 3⅛ pounds. What was the weight of the brick?

add 28 14⅜

2. A flagstaff was made of two poles spliced together. The lower pole was 28½ feet high. After the upper pole was spliced on, it added 14⅜ feet. What was the entire height of the pole?

7 ÷ 42 $\frac{7}{42}$, reduce

3. A great mountain glacier moved 7 feet in 42 years. How far did it move in 1 year? Do not let anyone help you to answer.

4. A street fair was given to aid a summer mission for sick children. The receipts showed: 26 dollars; 89 half dollars; 36 quarters; 100 dimes; 180 nickels. What was the entire amount?

5. A nail 3½ inches long was driven through a board 1½ inches thick. How far did it protrude on the other side?

6. The monthly receipts from a house containing 24 apartments amounted to $876. What was the ~~average~~ rent of each apartment?

7. A Boy Scout Club composed of 18 boys camped for 14 days at a cost of $8½ apiece. Find the cost for all.

It is sometimes desirable to give problems in which more data appear than is needed for the solution. In real life problems are usually of this character.

8. A city of ~~360,000 people is situated~~ on both ~~sides of~~ the ~~river. If [illegible] of the~~ people live on one side, how ~~many~~ people ~~live~~ on ~~the other?~~ ~~Diagram.~~

9. A farmer bought ~~46 bags~~ of clover seed at $6 a bushel. How much did he pay for all if each bag contained 2½ bushels?

10. Mrs. Henry's new rugs cost $96. Her curtains cost ⅜ as much. How much did her curtains cost? Diagram.

11. A bathroom is 12 feet long, 9 feet wide and 8½ feet high. How many yards of border would be required for papering this room?

12. How many days are there from September 16 to Christmas? Count both days.

13. Make an original problem about Charles and his canoe that the class can solve without pencil.

14. Alice went to visit her aunt. The train left at 6:30 P.M. and arrived at her aunt's city the next day at 3 P.M. How long a time was she on the train?

15. Find your own height to an eighth of an inch. How much more is it than one yard?

16. In a school of 486 pupils, $\frac{5}{8}$ of the children are of American parentage. How many children are of foreign parentage? Diagram.

17. If 8 pounds of coffee cost $3.25, how much will 24 pounds cost? Two ways.

18. In an orchard are 7448 peach trees planted 76 in a row. How many rows are there?

19. A dealer shipped $12\frac{2}{3}$ dozen eggs. If $\frac{1}{8}$ of them are broken, how many are left? Diagram.

20. What is the combined area of the Great Lakes?

a. Superior — Thirty thousand eight hundred twenty-nine square miles.

b. Michigan — Twenty-one thousand seven hundred twenty-nine square miles.

c. Huron — Twenty-two thousand three hundred twenty-two square miles.

d. Erie — Nine thousand nine hundred square miles.

e. Ontario — Seven thousand one hundred four square miles.

21. Walter gathered 10 bushels of tomatoes. This was $\frac{1}{2}$ of the quantity that Ralph gathered. They sold all the tomatoes for $45. What share of the money did Walter get? How much was it? Diagram.

22. If 50 pounds of clover seed were used to sow 4 acres, how much seed will be required to sow 12 acres?

23. How many pounds are there in 70 ounces? Express 70 ounces fractionally as pounds.

69.* *Addition of Mixed Numbers — Unlike Fractions.*

See p. 41 for previous lesson.

1. *For study.* On a grocery shelf were $5\frac{3}{4}$ dozen cans of tomatoes and $3\frac{1}{2}$ dozen cans of corn. How many dozen cans were there in all?

Think	Write
$5\frac{3}{4}$ doz. $= 5\frac{3}{4}$ doz.	$5\frac{3}{4}$ doz. $\mid$ 3
$3\frac{1}{2}$ " $= 3\frac{2}{4}$ "	$3\frac{1}{2}$ " $\mid$ 2
$8\frac{5}{4}$ doz. or $9\frac{1}{4}$ doz.	$9\frac{1}{4}$ doz. $\mid$ $\frac{5}{4} = 1\frac{1}{4}$

There are $9\frac{1}{4}$ doz. cans on the shelf.

Make sure that the pupils understand that to write the numerators without the denominators is merely a matter of convenience in adding, and that the mental process is precisely that which they have been using.

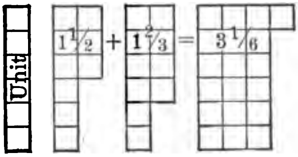
2. A farmer sold $13\frac{3}{8}$ bushels of sweet potatoes and $27\frac{3}{4}$ bushels of white potatoes. How many bushels did he sell in all?

3. Dan read $3\frac{2}{3}$ hours on Monday and $4\frac{1}{2}$ hours on Tuesday. How many hours did he read during the two days?

4. It requires $3\frac{1}{3}$ yards of cloth for a coat, $2\frac{5}{6}$ yards for trousers and $\frac{5}{6}$ of a yard for a vest. How much cloth in this suit of clothes?

5. William deposited \$$7\frac{1}{4}$ in the bank one week, \$$12\frac{1}{2}$ the next, and \$$11\frac{3}{4}$ the third week. How much did he deposit in the three weeks?

70. *With squared paper or by drawing illustrate any two of the following:*



1. $1\frac{1}{2} + 1\frac{2}{3} = 3\frac{1}{6}$.
2. $2\frac{2}{3} + 1\frac{3}{4} = ?$
3. $1\frac{5}{6} + 3\frac{1}{3} = ?$
4. $3\frac{1}{3} + 1\frac{5}{9} = ?$
5. $1\frac{7}{8} + 2\frac{1}{4} = ?$

71. *Written Problems.*

1. Cretonne is a yard wide. How many yards must be bought for both sides of a comfort 6 feet wide and 7 feet long? How much will it cost at 75 cents a yard?

2. A boy works at a grocery 2 hours every day after school and 8 hours on Saturday. He receives $4.50 a week. How much is that per hour?

3. Last year Albert paid 55¢ for seeds and 25¢ for young plants. He sold his garden products as follows: lettuce 1\frac{1}{4}$; radishes $$\frac{3}{4}$; spinach 90¢; onions 35¢; tomatoes $$\frac{1}{4}$. How much did he make on his garden?

4. Bob inclosed a chicken lot in a corner of his back yard which was already fenced. The lot was 28$\frac{1}{2}$ feet long and 16$\frac{1}{2}$ feet wide. How many yards of wire netting did he use? What did it cost at 39 cents a yard?

5. The pupils of a certain school made 7879 pin discs, 309 quilts, 9786 property bags, 2978 comfort pillows, 9786 towels, 9609 napkins and 18,700 handkerchiefs for the Junior Red Cross. How many articles was that in all?

6. A room is 27$\frac{1}{2}$ feet long and 18$\frac{3}{4}$ feet wide. How many feet of picture molding will be needed for this room?

7. The distance between two cities is 774 miles. If a man goes from one to the other by rail in 18 hours, at what rate per hour does he travel?

8. A grocer buys 4 bu. of plums at $2.50 a bushel and sells them at 10¢ a quart. How much does he gain?

9. In a library there are 788 story books for children, $\frac{1}{2}$ as many science books and 3 times as many histories as science books. How many books in the library?

10. At an election for mayor the successful candidate received 56,475 votes, and the unsuccessful candidate 38,965 votes. Find the majority of the former.

11. 2231 pounds of coal were put into 23 bags holding equal weights. How many pounds were in each bag?

12. Make an original problem.

72. *Multiply at sight:*

1. $\begin{array}{r}56\\ \underline{12}\end{array}$ **3.** $\begin{array}{r}73\\ \underline{12}\end{array}$ **5.** $\begin{array}{r}38\\ \underline{12}\end{array}$ **7.** $\begin{array}{r}24\\ \underline{12}\end{array}$ **9.** $\begin{array}{r}87\\ \underline{12}\end{array}$ **11.** $\begin{array}{r}65\\ \underline{12}\end{array}$ **13.** $\begin{array}{r}78\\ \underline{12}\end{array}$

2. $\begin{array}{r}79\\ \underline{11}\end{array}$ **4.** $\begin{array}{r}48\\ \underline{11}\end{array}$ **6.** $\begin{array}{r}96\\ \underline{11}\end{array}$ **8.** $\begin{array}{r}97\\ \underline{11}\end{array}$ **10.** $\begin{array}{r}69\\ \underline{11}\end{array}$ **12.** $\begin{array}{r}89\\ \underline{11}\end{array}$ **14.** $\begin{array}{r}49\\ \underline{11}\end{array}$

Do you see a "quick way" to tell the answer when a number of two figures is multiplied by 11?

73. *Divide at sight:*

1. $11\overline{)420}$ **3.** $11\overline{)572}$ **5.** $11\overline{)876}$ **7.** $11\overline{)792}$

2. $12\overline{)396}$ **4.** $12\overline{)756}$ **6.** $12\overline{)495}$ **8.** $12\overline{)408}$

74. *Subtract at sight:*

1. $\begin{array}{r}62{,}013\\ \underline{58{,}769}\end{array}$ **3.** $\begin{array}{r}53{,}466\\ \underline{47{,}897}\end{array}$ **5.** $\begin{array}{r}64{,}652\\ \underline{57{,}976}\end{array}$ **7.** $\begin{array}{r}83{,}654\\ \underline{26{,}898}\end{array}$ **9.** $\begin{array}{r}47{,}289\\ \underline{19{,}592}\end{array}$

2. $\begin{array}{r}92{,}412\\ \underline{57{,}869}\end{array}$ **4.** $\begin{array}{r}56{,}012\\ \underline{34{,}987}\end{array}$ **6.** $\begin{array}{r}31{,}821\\ \underline{17{,}896}\end{array}$ **8.** $\begin{array}{r}71{,}142\\ \underline{67{,}843}\end{array}$ **10.** $\begin{array}{r}76{,}543\\ \underline{45{,}678}\end{array}$

75. *Written Dictation*

1. Three months are what fraction of a year? Two answers.

2. What is the sum of $\frac{1}{2}$ and $\frac{1}{4}$?

3. A towel is 28 inches long after being hemmed at both ends. How long was the piece of crash if each hem took $\frac{1}{2}$ inch of goods?

4. A mechanic was paid for $2\frac{1}{2}$ hours of work at 90 cents an hour. How much did he receive?

5. If 8 pounds of coffee cost $4, how much do 4 pounds cost?

76. *Oral Exercise.*

1. *Add:*

46	52	78	93	64	57
87	69	45	58	78	87
56	37	57	48	78	67
65	87	58	68	89	49

2. *Add:*

$2\frac{2}{4}$	$3\frac{5}{8}$	$6\frac{7}{9}$	$8\frac{2}{3}$
$3\frac{3}{4}$	$5\frac{6}{8}$	$7\frac{5}{9}$	$5\frac{2}{3}$
$5\frac{1}{2}$	$6\frac{7}{9}$	$2\frac{3}{4}$	$6\frac{5}{8}$
$7\frac{1}{2}$	$5\frac{4}{9}$	$7\frac{3}{4}$	$7\frac{1}{8}$

3. In an orchard were 100 trees. If only $\frac{3}{4}$ of them lived, how many died?

4. A bathroom is 6 feet long by 8 feet wide. The bath tub covers $\frac{1}{4}$ of the floor space. How many square feet does the tub cover?

5. 30 books @ $2.00 cost $——.
30 books @ $1.00 cost $——.
30 books @ $ .50 cost $——.
30 books @ $ .25 cost $——.

6. Mary was born in 1909. How old is she?

7. There are $5\frac{1}{2}$ yards in 1 rod. How many yards in 2 rods?

8. It is 21 miles to the river. After you have gone 7 miles, what part of the distance remains?

9. How many apples were cut up to make 12 quarters? 16 quarters?

10. Change each of the following to inches:
$\frac{1}{2}$ yd.; $\frac{1}{9}$ yd.; $\frac{3}{4}$ yd.; $\frac{5}{9}$ yd.; $\frac{1}{3}$ yd.; $\frac{5}{6}$ yd.

11. There were 87 pounds of butter in a tub that weighed 15 pounds. How much did both weigh?

12. How many feet are there in 29 yards?

13. Make an original problem about your school.

14. Which would be cheaper, to pay $\$\frac{6}{8}$ for a pair of gloves or $\$\frac{3}{4}$?

15. From a piece of cloth containing $13\frac{5}{8}$ yards a piece 7 yards long was sold. How many yards remained?

16. The pony track was $\frac{1}{4}$ of a mile around. When Charles had ridden around it 11 times, how many miles had he ridden?

17. A man owned 160 acres of land. He sold $\frac{3}{8}$ of it. How many acres did he sell? What part remained?

18. If 4 cows are valued at $500, what will be the price of 7 cows at the same rate?

19. Aunt Helen gave each of us 10 children a quarter of an orange. How many oranges had she divided? How much had she left?

20. Jane wishes to make 9 yards of lace. When she has made 3 yards, what part has she still to make? Two answers.

21. Ned had 36 newspapers. He sold $\frac{2}{3}$ of them at 3 cents each. How much did he get for them?

22. What are $\frac{2}{3}$ of 75? $\frac{3}{4}$ of 60? $\frac{7}{8}$ of 96? $\frac{5}{9}$ of 72?

23. 6 is $\frac{1}{8}$ of what? 12 is $\frac{1}{3}$ of what? 18 is $\frac{1}{2}$ of what?

24. If a quarter of a yard of ribbon costs 10 cents, how much will $2\frac{1}{4}$ yards cost? Two ways.

25. Six boys hired a boat for a day's fishing and agreed to pay the owner $1.50. What was each boy's share?

26. After walking $4\frac{1}{8}$ miles, I still have $1\frac{3}{8}$ miles to go. What is the length of my trip?

27. How many yards of hemming would be required for a dozen napkins 18 inches square, if only the ends are hemmed?

28. How many people can be served with a quarter of a melon each from 16 melons?

29. How many square yards are in a garden 12 feet wide and 15 feet long?

77. *Find the sum:*

1. *For study:*

$$\begin{array}{r|l} 87\frac{1}{2} & 4 \\ 46\frac{1}{4} & 2 \\ 39\frac{1}{8} & 1 \\ \hline 172 & \frac{7}{8} \end{array}$$

$172\frac{7}{8}$

2.	4.	6.	8.
$67\frac{1}{3}$	$85\frac{1}{4}$	$98\frac{5}{6}$	$56\frac{1}{2}$
$48\frac{4}{9}$	$63\frac{1}{3}$	$47\frac{1}{2}$	$49\frac{3}{4}$
$\underline{56\frac{2}{3}}$	$\underline{47\frac{1}{6}}$	$\underline{65\frac{2}{3}}$	$\underline{28\frac{7}{8}}$

3.	5.	7.	9.
$29\frac{3}{4}$	$57\frac{5}{9}$	$68\frac{2}{3}$	$47\frac{3}{4}$
$36\frac{5}{8}$	$28\frac{1}{3}$	$75\frac{1}{2}$	$69\frac{1}{2}$
$\underline{87\frac{7}{8}}$	$\underline{36\frac{7}{9}}$	$\underline{87\frac{5}{6}}$	$\underline{42\frac{7}{8}}$

78. *Subtract without pencil:*

See previous lesson, p. 24.

1.	Think:	Say:
54	54 – 20 = 34	34, 28.
$\underline{26}$	34 – 6 = 28	

For those using the Austrian method:

20 and 34 are 54
6 and 28 are 34

2.	4.	6.	8.	10.	12.
81	52	72	41	40	63
$\underline{59}$	$\underline{19}$	$\underline{46}$	$\underline{17}$	$\underline{28}$	$\underline{39}$

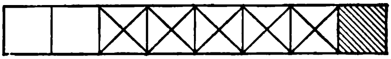
3.	5.	7.	9.	11.	13.
47	83	44	66	75	50
$\underline{18}$	$\underline{69}$	$\underline{18}$	$\underline{38}$	$\underline{56}$	$\underline{27}$

79. *Find the sum:*

1.	2.	3.	4.	5.	6.
487	788	759	498	888	485
285	688	668	569	789	799
969	857	597	879	588	589
486	647	664	776	487	688
956	359	696	479	576	579
689	569	399	797	668	278
598	337	688	688	749	759
479	998	989	379	996	588
968	979	397	687	979	693
$\underline{497}$	$\underline{999}$	$\underline{678}$	$\underline{897}$	$\underline{899}$	$\underline{888}$

80. *Subtraction of Like Fractions.*

1. *For study.* Betty cut $\frac{5}{8}$ of a yard of pink crêpe for a doll dress from a piece containing $\frac{7}{8}$ of a yard. How much crêpe remained in the piece?



$\frac{7}{8}$ yd. − $\frac{5}{8}$ yd. = $\frac{7-5}{8}$ yd. = $\frac{2}{8}$ yd. or $\frac{1}{4}$ yd.

$\frac{1}{4}$ of a yard of crêpe remained in the piece.

2. Oakland is $18\frac{3}{4}$ miles away. After I have ridden $9\frac{1}{4}$ miles toward it, how many miles have I yet to go?

3. Mr. Branham sold $12\frac{1}{3}$ acres from a tract of land containing $36\frac{2}{3}$ acres. How many had he left?

4. From a piece of lace containing $12\frac{8}{9}$ yards, $9\frac{5}{9}$ yards were cut. What was the length of the piece that remained?

5. A piece of crash $32\frac{7}{8}$ inches long is made into a towel. If the hem at each end of the towel required $\frac{3}{8}$ of an inch of goods, what is the length of the towel?

6. From a cask containing $40\frac{3}{4}$ gallons of water, $12\frac{1}{4}$ gallons were drawn at one time and $15\frac{1}{4}$ gallons at another. How many gallons remained in the cask?

7. From a can containing $30\frac{7}{8}$ lb. of lard, $8\frac{3}{8}$ lb. were taken. How much lard remained in the can?

81. *Find the sum:*

1. $79\frac{1}{4}$ $58\frac{1}{2}$ $86\frac{3}{4}$ $68\frac{3}{8}$	**3.** $46\frac{1}{2}$ $35\frac{1}{3}$ $93\frac{1}{6}$ $42\frac{2}{3}$	**5.** $85\frac{5}{6}$ $96\frac{1}{3}$ $38\frac{1}{2}$ $49\frac{2}{3}$	**7.** $98\frac{3}{4}$ $78\frac{1}{8}$ $65\frac{5}{8}$ $43\frac{1}{2}$
2. $39\frac{5}{8}$ $82\frac{3}{4}$ $97\frac{1}{8}$ $68\frac{1}{2}$	**4.** $46\frac{5}{6}$ $27\frac{1}{2}$ $16\frac{2}{3}$ $59\frac{1}{6}$	**6.** $29\frac{3}{8}$ $56\frac{3}{4}$ $47\frac{1}{2}$ $85\frac{5}{8}$	**8.** $75\frac{5}{9}$ $54\frac{1}{3}$ $27\frac{7}{9}$ $86\frac{2}{3}$

82. *Meadowbrook Farm: V — Chickens. Square Measure.*

1. Mr. Henderson bought 2 dozen hens at $\$1\frac{3}{4}$ each. How much did they cost him?

2. He built for his hens a house with a floor space of 24 square yards. Draw rectangles to show 24 square yards in as many shapes as possible. Which of these shapes would be most practical?

Continue this exercise in drawing with other multiples, such as 12, 18, 36, etc. It will be found valuable not only as a means of vitalizing square measure but as an introduction to factoring.

3. From stiff paper construct a miniature henhouse like the one in the picture. Use for a scale, preferably, $1\frac{1}{2}$ inches to the foot. Before pasting cut out windows and doors.

a. Floor 18′ × 12′. Read 18 ft. by 12 ft.
b. Front wall 18′ × 8′.
c. Rear wall 18′ × 6′.
d. Side walls 12′ at base, with upper edge 8′ at front and 6′ at rear.
e. Roof 19′ × 14′.

4. The plasterer who laid the concrete floor marked it off into square yards. Do that on the floor of your henhouse.

5. How much did Mr. Henderson pay for the cement floor at $2.35 a square yard?

6. The cement foundation cost $8, and the filling of cinders and gravel under the floor ¾ as much. What was the cost of this part of the henhouse?

7. The lumber bill was $63 and the carpenter labor 4/7 of that amount. What was the amount of this item? Add $3 for hardware and nails.

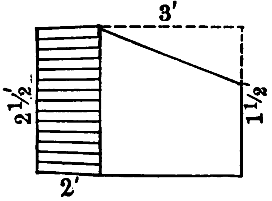
8. The painter figured 31½ square yards of paint at 18 cents per square yard. What was his bill, if it included also $3.25 for glass?

9. What was the entire cost of the henhouse?

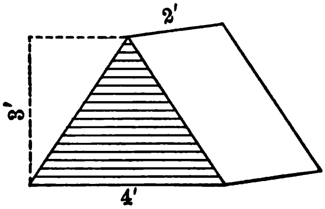
10.† Mr. Henderson bought 400 yards of wire fencing for his chicken yard. Why did he decide to make the yard 100 feet square rather than 150 feet long by 50 feet wide? Make drawing to prove your conclusion.

11. The Henderson boys made coops for the hens. Paul's coops were like Figure *a*. Construct one like it on the scale of 2 inches to the foot. Use stiff paper or thin wood.

a



b



12. Robert's coops were like Figure *b*. Construct a coop of that style on the scale of 4 inches to the foot. The rear of this coop is a triangular piece of board.

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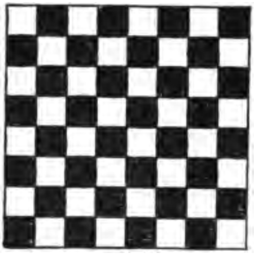
† See Table of Contents.

83.* *Square Measure — continued.*

See previous lesson on p. 51.

1. *For study.* How many squares in a checker board if there are 8 squares in one row and 8 rows of squares?

How many squares in 1 row?
How many squares in 8 rows?
How many squares in the checker board?
Continue until the class grasps the principle.



Write
8 rows = 8 × 8 squares = 64 squares.
There are 64 squares in the checker board.

2. How many caramels an inch square would exactly cover the bottom of a box 9 inches long and 4 inches wide?

3. How many tiles 1 foot square will be needed for a terrace 30 feet long and 9 feet wide?

4. How will your knowledge of the table of linear measure help you with the table of square measure?

Square Measure

Complete and learn:

—— square inches make 1 square foot.
—— square feet make 1 square yard.
—— square yards make 1 square rod.
—— square rods make 1 acre.

Remember that while an acre contains 160 square rods it is not itself a perfect square.

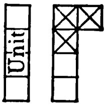
84. *Find the quotient:*

1. 558,450 ÷ 137
2. 742,997 ÷ 146
3. 551,856 ÷ 139
4. 333,972 ÷ 168
5. 621,913 ÷ 159
6. 771,696 ÷ 164
7. 432,178 ÷ 176
8. 134,375 ÷ 165
9. 661,319 ÷ 189

85.* *Subtraction of Mixed Numbers — Fraction in Subtrahend Larger than in Minuend.*

See p. 50 for previous lesson.

1. *For study.* Mrs. Layman poured $\frac{3}{4}$ of a gallon of vinegar from a jug containing $1\frac{1}{4}$ gallons. How much remained?



Think

$1\frac{1}{4}$ gal. = $\frac{5}{4}$ gal.
$\frac{3}{4}$ gal. = $\frac{3}{4}$ gal.
$\frac{2}{4}$ gal.

Write

$\overset{0}{\cancel{1}}\frac{1}{4}$ gal.	$\overset{5}{\cancel{1}}$ gal.
$\frac{3}{4}$	3
$\frac{2}{4}$ gal.	$\frac{2}{4}$ gal.

There remained $\frac{2}{4}$ or $\frac{1}{2}$ of a gallon.

2. *For study.* Anna bought $5\frac{1}{3}$ yards of lace. She used $2\frac{2}{3}$ yards to trim a dress. How much lace had she left?

$5\frac{1}{3}$ yd.	$4\frac{4}{3}$ yd.
$2\frac{2}{3}$	$2\frac{2}{3}$
$2\frac{2}{3}$ yd.	$2\frac{2}{3}$ yd.

Anna had $2\frac{2}{3}$ yards left.

3. George weighs $84\frac{3}{4}$ pounds and James weighs $93\frac{1}{4}$ pounds. How much heavier is James than George?

4. A room is $14\frac{1}{3}$ feet long and $11\frac{2}{3}$ feet wide. How much longer is it than wide?

5. A tailor had a piece of cloth containing $24\frac{1}{8}$ yards. From this piece he used $3\frac{3}{8}$ yards to make a pair of trousers. How much cloth remained?

6. If my finger nail is $\frac{1}{2}$ inch long and my whole finger is $3\frac{1}{4}$ inches long, how much of my finger is not covered by the nail?

7. If you are building a playhouse and need a board $7\frac{5}{8}$ inches long and you have a board $11\frac{1}{8}$ inches long, how much must you saw off?

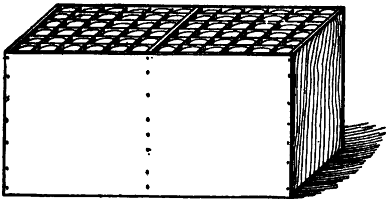
Subtract:

8. $\begin{array}{r}41\frac{1}{3}\\ \underline{39\frac{2}{3}}\end{array}$	**10.** $\begin{array}{r}70\frac{1}{4}\\ \underline{18\frac{3}{4}}\end{array}$	**12.** $\begin{array}{r}52\frac{5}{8}\\ \underline{47\frac{5}{8}}\end{array}$	**14.** $\begin{array}{r}63\frac{2}{7}\\ \underline{48\frac{6}{7}}\end{array}$
9. $\begin{array}{r}84\frac{3}{11}\\ \underline{27\frac{7}{11}}\end{array}$	**11.** $\begin{array}{r}91\frac{1}{6}\\ \underline{43\frac{5}{6}}\end{array}$	**13.** $\begin{array}{r}35\frac{2}{5}\\ \underline{17\frac{4}{5}}\end{array}$	**15.** $\begin{array}{r}54\frac{2}{9}\\ \underline{29\frac{5}{9}}\end{array}$

86. *Meadowbrook Farm: VI — Chickens. Written.*

1. Mr. Henderson set one dozen hens on 13 eggs each. If $\frac{11}{12}$ of the eggs hatched, how many little chicks had he?

2. Mr. Henderson also bought 360 eggs for hatching. They were crated as shown in the picture with 3 dozen eggs in each layer. How many layers of eggs were there? Two ways.



3. The eggs cost $12 per hundred. How much did one egg cost?

4. Why was Mr. Henderson willing to pay $12 a hundred for eggs to hatch when eggs for table use were selling at 64 cents a dozen? What was the difference in price per dozen?

5. The eggs were placed in an incubator. At the end of 21 days $\frac{3}{5}$ of them had hatched. How many little chicks were there? Diagram.

6. If the eggs cost $40.80 and the fuel for the incubator was $7.20, how much was the total cost?

7. Later in the season, Mr. Henderson sold 85 broilers at an average of $1.60 each. How much did they bring him?

8. If it had cost him 60¢ to produce each broiler, how much did he clear on the whole lot?

9. He sold 50 roasting hens at $2.25 each. They had cost $1.50 to produce. What did Mr. Henderson realize on them?

10. Mr. Henderson's total income from his chickens was $172.80. After deducting $36 for the incubator, $7.20 for the oil, and $43.20 for production, how much was his profit?

87.* *Subtraction of Unlike Fractions.*

Solve with integers and fractions.

1. *For study.* From a can containing $\frac{3}{4}$ of a gallon (3 quarts) Mrs. Barnard poured $\frac{1}{8}$ of a gallon (1 pint) of milk. How much milk remained in the can?

Solution by Integers	Solution by Fractions
3 qt. = 6 pints	$\frac{3}{4}$ gal. = $\frac{6}{8}$ gal.
1 pt. = 1	$\frac{1}{8}$ gal. = $\frac{1}{8}$
5 pints	$\frac{5}{8}$ gal.

There remained $\frac{5}{8}$ of a gallon (5 pints) of milk in the can.

2. A newsboy earned \$$\frac{3}{4}$ and spent \$$\frac{1}{2}$ for a pair of gloves. How much money had he left?

3. From $\frac{7}{8}$ lb. of earth, $\frac{1}{4}$ lb. of sand was removed. What was the weight of the earth that remained?

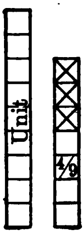
4. Mr. Beveridge owned $\frac{7}{9}$ of a vessel and sold $\frac{2}{3}$ of it. What part did he still own?

5. Roy is awake $\frac{2}{3}$ of the twenty-four hours in the day. He studies $\frac{1}{6}$ of the twenty-four hours. How much time has he left?

6. From a strip of oil cloth $\frac{7}{8}$ yd. long I cut a piece measuring $\frac{1}{4}$ yd. How long was the piece that remained?

88. *With squared paper or by drawing illustrate any two of the following:*

1. $\frac{7}{9} - \frac{1}{3} = \frac{4}{9}$.



2. $\frac{7}{8} - \frac{1}{2} = ?$
3. $\frac{5}{6} - \frac{1}{3} = ?$
4. $\frac{1}{2} - \frac{1}{3} = ?$
5. $\frac{3}{4} - \frac{1}{2} = ?$
6. $\frac{7}{10} - \frac{2}{5} = ?$
7. $\frac{4}{5} - \frac{1}{2} = ?$
8. $\frac{5}{8} - \frac{1}{2} = ?$
9. $\frac{2}{3} - \frac{1}{2} = ?$

Give answers to the above without using pencil.

89. *Oral Exercises.*

Before solving the concrete problems, name the operation to be used.

1. *Add and subtract:*

87	53	74	46	45	60
29	19	36	17	28	29
41	82	42	61	70	53
37	59	28	48	36	27

2. Name the figures used in writing one million six. How many periods would be needed?

3. If 8 men can do a piece of work in 32 days, in how many days can one man do it?

4. When 12 spools of thread cost 60 cents, how much do 3 spools cost?

5. A garden hose is $15\frac{2}{3}$ yards long. What is its length in feet?

6. A barrel contains 18 gallons of vinegar. If $6\frac{1}{2}$ gallons are sold, how many gallons remain?

7. How many ounces are there in $1\frac{3}{4}$ lb.? In $2\frac{5}{8}$ lb.?

8. Grace had $4\frac{5}{6}$ yards of skirt braid. After using $1\frac{1}{3}$ yards, how much had she left?

9. A colt that cost $60 was sold for $\frac{7}{6}$ of the cost. What was the selling price?

10. If each side of a triangle is $1\frac{1}{4}$ inches long, how long is the perimeter? Perimeter means "distance around."

11. A three-pound roast cost $1.35. After it was cooked it weighed only 2 pounds. How much had the roasted meat cost per lb.? Allow 5 cents for the cost of cooking.

12. How many yards of fencing will be needed to inclose a garden 24 feet square?

90.* *Subtraction of Mixed Numbers — Unlike Fractions. Fractions in Subtrahend Larger than in Minuend.*

See p. 54 for previous lesson.

1. *For study.* A clerk sold $2\frac{3}{4}$ yards of cloth from a bolt containing $12\frac{1}{8}$ yards. How many yards remained?

$$\begin{array}{rcl}
\multicolumn{3}{c}{\text{Think}} \\
12\frac{1}{3}\text{ yd.} & = & 11\frac{9}{8}\text{ yd.} \\
2\frac{3}{4}\text{ yd.} & = & 2\frac{6}{8}\text{ yd.} \\
\hline
9\frac{3}{8}\text{ yd.} & & 9\frac{3}{8}\text{ yd.}
\end{array}
\qquad\qquad
\begin{array}{r|c}
\multicolumn{2}{c}{\text{Write}} \\
 & 9 \\
12\frac{1}{8}\text{ yd.} & \cancel{1} \\
2\frac{3}{4} & 6 \\
\hline
9\frac{3}{8}\text{ yd.} & \frac{3}{8}
\end{array}$$

$9\frac{3}{8}$ yards remained.

2. From a can containing $3\frac{1}{4}$ gallons of milk, $\frac{1}{2}$ of a gallon was taken. How many gallons were left?

3. A boy studied $1\frac{1}{3}$ hours on Monday and $\frac{1}{2}$ hour on Tuesday. How many more hours did he study on Monday than on Tuesday?

4. A girl had to walk $3\frac{3}{8}$ miles to her grandmother's house. After she had walked $2\frac{3}{4}$ miles she stopped to rest. How much farther must she go?

5. Mr. Staples traveled $46\frac{1}{2}$ miles directly east from his home and then turned west and traveled $27\frac{5}{6}$ miles. How far was he from home?

6. Mr. Allen owed his grocer a bill of $\$8\frac{1}{2}$. He paid $\$5\frac{3}{4}$ on it. How much did he still owe?

91. *Add:*

1.	2.	3.	4.	5.	6.
784	689	798	999	556	983
697	431	576	827	955	788
766	878	556	996	741	679
974	663	538	765	969	481
788	765	472	447	588	729
784	474	899	983	627	836
321	587	987	159	587	275
679	545	756	764	793	945
788	296	972	685	589	689
883	956	949	986	568	765

92. *Add:*

1.	2.	3.	4.	5.
$39\frac{2}{3}$	$87\frac{1}{8}$	$29\frac{5}{6}$	$28\frac{3}{4}$	$48\frac{7}{8}$
$47\frac{3}{4}$	$46\frac{3}{4}$	$87\frac{2}{3}$	$37\frac{2}{3}$	$87\frac{1}{4}$
$69\frac{5}{6}$	$97\frac{1}{2}$	$47\frac{1}{2}$	$92\frac{5}{6}$	$72\frac{1}{2}$
$27\frac{1}{2}$	$56\frac{7}{8}$	$52\frac{1}{6}$	$46\frac{1}{2}$	$69\frac{3}{4}$

93. *Subtract:*

1. $7\frac{1}{2}$ $3\frac{2}{3}$	4. $9\frac{1}{2}$ $5\frac{3}{4}$	7. $12\frac{1}{6}$ $8\frac{1}{2}$	10. $18\frac{1}{3}$ $12\frac{5}{9}$
2. $21\frac{1}{3}$ $17\frac{1}{2}$	5. $35\frac{1}{3}$ $16\frac{5}{12}$	8. $49\frac{1}{2}$ $15\frac{4}{6}$	11. $68\frac{1}{4}$ $43\frac{1}{3}$
3. $54\frac{1}{7}$ $26\frac{2}{3}$	6. $91\frac{1}{2}$ $78\frac{7}{8}$	9. $63\frac{1}{4}$ $17\frac{4}{5}$	12. $82\frac{1}{5}$ $79\frac{7}{10}$

94. *Find the quotient:*

1. 1,586,991 ÷ 196
2. 1,731,245 ÷ 149
3. 1,498,040 ÷ 167
4. 1,551,604 ÷ 135
5. 1,090,629 ÷ 137
6. 1,434,453 ÷ 158
7. 1,008,700 ÷ 146
8. 1,715,353 ÷ 189

95. *Digging a Tunnel — A Game.*

Place upon the board a row of examples in subtraction.

$2\frac{3}{4}$	$5\frac{7}{8}$	$2\frac{5}{6}$	$1\frac{1}{2}$	$6\frac{7}{9}$	$8\frac{5}{8}$	
$1\frac{1}{2}$	$3\frac{1}{2}$	$1\frac{1}{3}$	$\frac{3}{8}$	$3\frac{2}{3}$	$2\frac{1}{4}$	etc.

Some of the great tunnels of the world, for example, the Simplon, were dug from both ends at once. In this game two children are sent to the board and begin at opposite ends to write results as rapidly as they can. The child who writes the most answers correctly wins the game. Boys might race with girls or one row with another. While the two pupils are working at the board, the rest of the class can be writing the same answers for practice. This game can be used with the other three processes as well.

Ethel

96. *Written Problems.*

1. Madge bound her doll's quilt with tape. The quilt was $14\frac{1}{2}$ inches long and $10\frac{3}{4}$ inches wide. She used $\frac{3}{8}$ of an inch of tape for each corner. How much tape did she use in all?

2. When macaroni is 20 cents a pound, is it cheaper to buy it by the single pound or in a 25-pound package for $4.25? How much?

3. A party of Boy Scouts tramped 42 miles in 4 days. They walked $12\frac{1}{2}$ miles the first day, $11\frac{3}{4}$ miles the second, $10\frac{3}{4}$ miles the third. How far did they walk the fourth day?

4. How long was Margaret in making a cushion cover if it took her 1 hour and 45 minutes to sew the cover and $3\frac{1}{2}$ hours to embroider the initials?

5. When 5 bags of coffee cost $27.50, what will 15 bags cost?

6. William and Robert made $4\frac{1}{2}$ gallons of lemonade for a fair. They sold all but $\frac{3}{4}$ of a gallon. How much did they sell?

7. A man traded his house worth $6,500 for 25 acres of land worth $300 an acre. How much did he gain?

8. A grocer mixed 5 pounds 4 ounces of Java coffee with 4 pounds 8 ounces of Mocha coffee. What was the weight of the mixture? Write answer as a mixed number.

9. Find the cost of $3\frac{3}{4}$ pounds of chocolate at 60¢ a pound.

10. How many square feet are there in the floor of a hall which is 19 feet long and 7 feet wide?

11. Mrs. Brown bought $16\frac{2}{3}$ yards of cloth from which she made the twins' dresses exactly alike. How many yards of cloth were in each dress?

12. When oranges are 36¢ a dozen, what must I pay for $3\frac{1}{3}$ dozen?

13. One customer paid $3.60 for ribbon at 24¢ a yard and another a like amount for ribbon at 36¢ a yard. How much ribbon ~~does~~ each receive?

14. ~~Alice had $1.56 and her father gave~~ her some more [redacted] Alice and her money ~~which the class~~ can solve without a pencil.

15. If 7 barrels of flour cost $84, what will 21 barrels cost? Two ways.

16. Mrs. Hopkins paid these bills last month: milk, $2⅗; laundry $6.50; gas $4¾. What was the total amount paid?

17. A grocer picked 3⅞ bushels of bad apples from a lot containing 21¼ bushels. How many bushels of good apples had he left?

18. ~~Mr.~~ Fortney bought a horse for $135, a cow for $110, and a hog for $48. If he sold the three animals for $275, did he gain or lose, and how much?

19. How many square yards are there in 108 square feet?

20. A playground is 30 yards long and 20 yards wide. How many square yards does it contain?

21. Robert and his younger brother have together saved $1.80. Two-thirds of this belongs to Robert. How many cents belong to his younger brother?

22. If a clock strikes the quarter hours, how often will it strike in a week?

23. If 6 pounds of bird seed cost 72¢, what will 18 pounds cost?

24. Mr. Badger bought a house for $6000, paying ¾ of the price in cash and giving his note for the remainder. How much did he still owe?

25. If Gordon puts $.25 a week in his savings bank, how much does he save in a year?

26. At $2.75 each, how much will 8 sanitary drinking fountains cost?

5280 1085
3 3
5840 3255

27. Two grocers wish to exchange eggs and butter. How many pounds of butter at 60¢ a pound would pay for 12 dozen eggs at 45¢ a dozen?

28. In 3 boxes of candy, there are $1\frac{5}{8}$ lb., $3\frac{1}{2}$ lb., and $4\frac{3}{4}$ lb. How many pounds of candy are there in all?

29. There are 5280 feet in a mile. How many feet are there in $\frac{3}{8}$ of a mile?

30. In selling coffee at 48¢ a pound, a grocer gained $8\frac{3}{4}$¢ a pound. How much did the coffee cost him?

31. If $\frac{1}{4}$ of a man's wealth is in a mill, $\frac{1}{3}$ in a farm and the remainder is in mines, what part of his property is in mines?

32. In a school of 1085 children, $\frac{3}{7}$ are boys. How many boys are there? How many girls? $\frac{3}{7}$ × 1085

33. In two bins of potatoes there are $126\frac{1}{4}$ bushels. In one there are $62\frac{1}{2}$ bushels. How many are there in the other?

34. Robert had \$6.48. He spent $\frac{4}{9}$ of his money. How much money did he have left? $\frac{4}{9}$ 6.48

35. A man left to his wife $\frac{5}{16}$ of his property; to his son, $\frac{3}{16}$; to his niece, $\frac{1}{8}$; and to a charitable institution, all the remainder. What part did the charitable institution receive?

36. The boys in the school yard are playing tug-of-war. The weight of the two groups is approximately the same. There are nine boys in one group averaging 84 pounds each. The boys in the second group average 72 pounds each. How many boys in the second group? Mul 9 × 8 [illegible]

37. The sum of two numbers is $56\frac{3}{8}$. One of the numbers is $17\frac{3}{4}$. What is the other?

38. A grocer bought 56 sacks of potatoes averaging $2\frac{1}{4}$ bushels to the sack. He sold $\frac{2}{3}$ of his potatoes the first week. How many bushels did he sell?

39. The product of two numbers is 49,000. One of the numbers is 56. What is the other?

198

225 | 648

8 | 178

TEST PROBLEMS

Test Page I

This page and the one following contain types of exercises which the class should do readily before proceeding to more difficult work. A class percentage of not less than eighty should be required.

These pages can also be used for classes about to take up the work of Section Two.

I

Write answers only: 10,060,006

1. Write in figures: ten million sixty thousand six; in Roman numerals: 549.

2. Write in words: 9,049,096.

3. Albert is 12 years old. His father is 28 years his elder. How old is his father?

4. I had \$4 and spent \$1½ for a book. How much had I left?

5. Roy had 32 marbles and Frank ⅜ as many. How many marbles had Frank?

II

Show all work — time limit 25 minutes:

1. When apples are worth 60 cents a peck, how much are 2¾ bushels worth?

2. A bolt of bunting contained 50 yards. How many yards were left after 37¼ yards were sold?

3. A man who earns \$3600 a year, saves ⅓ of it. How many years will it take him to pay for a city lot the price of which is \$1200? 1200

4. A certain town had 500 people living in it in 1915. In 1917 it had 1500 people living in it. Draw a line an inch long to represent the size of the town in 1915. Draw a second line that will represent its size in 1917.

5. A merchant mixed 12⅜ pounds of Mocha coffee with 20¾ pounds of Java. How many pounds were there in the mixture?

Test Page II

III

Oral Problems

Before solving, name the operation to be used in the problem.

1. How many pint bottles of milk can be filled from a can containing $4\frac{1}{2}$ gallons?

2. If 4 acres of land yield 840 bushels of potatoes, how many bushels would 1 acre yield?

3. A fruit dealer sold 43 baskets of peaches and 19 baskets of crabapples. How many baskets of fruit did he sell in all?

4. How many pounds of candy are there in 18 boxes, each containing $\frac{1}{4}$ pound of candy?

5. Find the cost of 12 towels at 3 for $1.

IV

Write at dictation:

1. Add: $567 + 345 + 785 + 653 + 954 + 186 + 475 + 532 + 598 + 617$.
(two minutes)

2. Find the difference between $37\frac{1}{4}$ and $25\frac{3}{4}$.
(one minute)

3. Multiply 8076 by $97\frac{1}{4}$. (three minutes)

4. Add: $38\frac{3}{4} + 47\frac{1}{2} + 56\frac{5}{8}$. (two minutes)

5. Divide 126,217 by 156. (three minutes)

V

Each child one exercise: (oral)

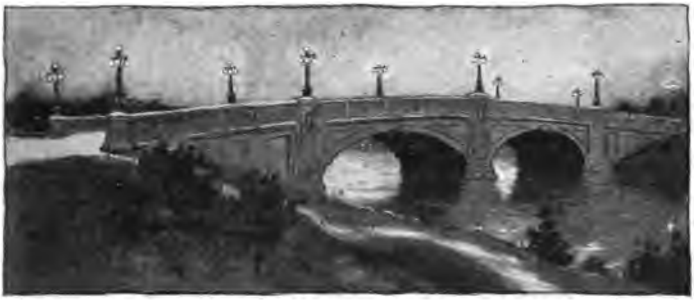
1. $\frac{1}{2} + \frac{1}{3} = ?$
$\frac{5}{6} - \frac{1}{3} = ?$
$\frac{2}{3}$ of $27 = ?$

2. $\frac{7}{8} - \frac{1}{4} = ?$
$\frac{7}{8} + \frac{1}{4} = ?$
$\frac{5}{9}$ of $63 = ?$

3. $\frac{3}{4}$ of $36 = ?$
$\frac{5}{6} + \frac{1}{3} = ?$
$\frac{7}{9} - \frac{1}{3} = ?$

PART I — SECTION TWO

1. *Comparison of Halves, Fifths and Tenths.*



1. A beautiful stone bridge has 10 electric cluster lamps arranged in pairs as shown in the picture. Each lamp furnishes what part of the light? One pair of lamps furnishes what part? What part of the light is on one side of the bridge?

2. Francis had \$1 in his purse. He gave $\frac{1}{2}$ of the money for a fishing pole, $\frac{1}{5}$ of the money for a line, and $\frac{1}{10}$ of the money for hooks. How much money did he pay for each?

3.

1/5		1/5		1/5		1/5		1/5	
1/10	1/10	1/10	1/10	1/10	1/10	1/10	1/10	1/10	1/10
1/2					1/2				

Complete and learn:

$1 = \frac{?}{2}$
$1 = \frac{?}{5}$
$1 = \frac{?}{10}$

$\frac{1}{2} = \frac{?}{10}$
$\frac{2}{2} = \frac{?}{10}$

$\frac{1}{5} = \frac{?}{10}$
$\frac{2}{5} = \frac{?}{10}$
to
$\frac{5}{5} = \frac{?}{10}$

2. *Add:*

1. $25\frac{1}{2}$ $68\frac{1}{5}$ $57\frac{7}{10}$ $83\frac{3}{5}$	**3.** $29\frac{2}{3}$ $48\frac{1}{4}$ $79\frac{1}{12}$ $94\frac{1}{6}$	**5.** $89\frac{1}{2}$ $75\frac{2}{3}$ $47\frac{1}{2}$ $61\frac{1}{3}$	**7.** $57\frac{1}{4}$ $88\frac{5}{6}$ $94\frac{2}{3}$ $71\frac{3}{4}$	**9.** $56\frac{1}{9}$ $43\frac{2}{3}$ $32\frac{7}{9}$ $68\frac{1}{3}$
2. $46\frac{1}{2}$ $59\frac{1}{3}$ $87\frac{3}{4}$ $65\frac{7}{12}$	**4.** $27\frac{2}{3}$ $84\frac{1}{2}$ $96\frac{5}{6}$ $45\frac{1}{3}$	**6.** $87\frac{1}{3}$ $46\frac{5}{9}$ $93\frac{2}{3}$ $68\frac{7}{9}$	**8.** $43\frac{1}{2}$ $62\frac{5}{12}$ $89\frac{1}{4}$ $91\frac{2}{3}$	**10.** $84\frac{3}{10}$ $45\frac{1}{2}$ $27\frac{3}{5}$ $62\frac{9}{10}$

3. *Subtract:*

1. 71,431 26,932	**3.** 26,714 18,965	**5.** 84,326 17,549	**7.** 72,454 36,576	**9.** 73,383 24,688
2. 57,623 18,736	**4.** 46,924 26,958	**6.** 93,713 75,828	**8.** 61,457 34,968	**10.** 75,697 18,799

4. *Written Dictation.*

1. Two pints are what part of a gallon? Two answers.

2. Write one hundred ten thousand.

3. What is the sum of $1\frac{1}{2}$ and $\frac{3}{4}$?

4. Betty had 12 yellow chicks. Her mother gave her $\frac{2}{3}$ as many. How many had she then?

5. If an inch line represents $10, draw a line to represent $15.

5. *Add and subtract at sight:*

1. $36\frac{1}{2}$ $17\frac{1}{2}$	**4.** $41\frac{5}{12}$ $29\frac{1}{12}$	**7.** $74\frac{3}{4}$ $69\frac{1}{4}$	**10.** $62\frac{7}{8}$ $57\frac{3}{8}$
2. 50 $27\frac{1}{3}$	**5.** 80 $59\frac{5}{8}$	**8.** 30 $16\frac{2}{3}$	**11.** 90 $46\frac{2}{9}$
3. $43\frac{7}{10}$ $19\frac{3}{10}$	**6.** $61\frac{5}{6}$ $47\frac{1}{6}$	**9.** 60 $18\frac{4}{11}$	**12.** $52\frac{3}{14}$ $15\frac{1}{14}$

6. *Oral Problems.*

4 $\frac{4}{3}$ × 27

1. A street car carried 27 passengers on its out-going trip and $\frac{4}{3}$ of that number on its return trip. How many passengers were carried on the return trip? 3)52

2. A man traveled 72 miles in 12 hours. How many miles did he travel in 4 hours? Two ways.

3. Two thirds of a yard is how many times two thirds of a foot? Two ways.

4. \$$\frac{8}{4}$ is how much less than \$2.50?

5. Bob bought 50 papers at 2 cents each and sold them at $\frac{3}{2}$ of the cost. For how much did he sell them? Two ways.

6. The cost of $\frac{1}{4}$ of a yard of ribbon is what part of the cost of $\frac{3}{4}$ of a yard?

7. One day at Spring Lake 72 fish were caught. Of this number $\frac{7}{9}$ were perch. How many perch were caught?

8. A cake 5 inches high was 7 inches high when strawberries and whipped cream were added. The cream and berries added what fraction to the original height? The finished cake was what fraction of the original cake in height?

9. A house with a shingle roof cost \$8000. If the same house had been built with a tile roof, the cost would have been $\frac{9}{8}$ as much. How much would it have cost with the tile roof?

10. An oblong is 6 inches long and $\frac{1}{2}$ inch wide. How many square inches does it contain?

11. From $\frac{5}{12}$ of a glass of water $\frac{1}{4}$ of a glass was poured. What part of the glass remained filled?

12. A grocer bought a firkin of butter for \$25 and sold it at a gain of $\frac{1}{10}$. The selling price was what part of the cost? At what price was it sold?

7. *Find sum:*

8	4	7	8	6	9	7	6	9
3	6	5	9	5	6	8	6	4
2	6	8	4	7	9	6	7	6

7	4	8	9	7	7	2	9	7
2	7	5	4	3	8	5	2	4
5	8	5	4	6	8	3	9	8

It will be well for each member of the class to keep a record of the progress he makes in obtaining the results in the exercise above during a week's time. For this purpose copies of the exercise with the order of the examples changed from time to time should be placed upon the blackboard.

8. *Complete the following table:*

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	[illegible]	21	[illegible]	27	30	[illegible]	36
4	8	12	16	20	[illegible]	[illegible]	32	[illegible]	40	44	[illegible]
5	10	15	20	25	[illegible]	35	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	36	42	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	21	[illegible]	[illegible]	[illegible]	49	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	72	[illegible]	[illegible]	96
9	18	27	36	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	20	30	40	50	[illegible]	[illegible]	[illegible]	[illegible]	100	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	77	88	99	110	121	132
12	24	36	48	[illegible]	72	[illegible]	[illegible]	[illegible]	[illegible]	132	144

Complete:

1 = 1 × 1
4 = 2 × 2
9 = 3 × 3
to
144 = 12 × 12

a. Find two ways to count by 2, using this table. By 3. By 7.

b. Where do you find the product of 2 × 3? Of 3 × 4? etc.

c. For practice use the "Multiplication Race" found on page 75.

d. Draw a diagonal line from 1 through 4, 9, 16, 25 to 144.

3 14 14 3/2 4 4 6

170

9. *Written Problems.*

1. Jeanette practiced the piano on Monday, $\frac{3}{4}$ of an hour; Tuesday, 1 hour; Wednesday, $1\frac{1}{4}$ hours; Thursday, 1 hour; Friday, $\frac{3}{4}$ of an hour; Saturday, $1\frac{1}{2}$ hours. How many hours did she practice during the week? add 1

2. Albert is 18 years old. Susan is $\frac{5}{9}$ as old. What is their combined age? Draw a line to represent Albert's age and a second one to represent their combined age. Their combined age is what fraction of Albert's age? ans 10 yrs

3. Andy started to walk to his uncle's farm, a distance of $15\frac{1}{2}$ miles. After he had walked $7\frac{3}{8}$ miles, his grandfather overtook him in the wagon. How many miles did Andy ride?

4. If 8 men can build a wall in 56 days, how long will it take 2 men to build it? Mul. 56 x 4

5. A dressmaker had a piece of cloth containing 20 yards. For one garment she used $5\frac{1}{4}$ yards and for another $3\frac{1}{3}$ yards. How many yards remained in the piece? 20

6. Two men are 190 miles apart and are traveling toward each other. A travels 8 miles an hour and B, 11 miles an hour. In what time will they meet?

7. Mr. Hurd bought a launch for \$960 and sold it for $\frac{7}{8}$ of the cost. What was the selling price? ~~Diagram~~ 960 x 7 110

8. How many square yards of plastering are there in the ceiling of a room 18 feet long and 12 feet wide?

9. A milliner trimmed three hats. She used $3\frac{2}{3}$ yards of silk velvet for one, $3\frac{1}{2}$ yards for another and $4\frac{1}{6}$ yards for the third. How much did the velvet cost her at \$6.00 a yard?

10. At the circus an elephant pulled a weight of 8750 pounds. A horse pulled a weight $\frac{3}{14}$ as heavy. How many pounds did the horse pull?

By daily practice habituate the pupils in estimating results and in checking them.

1 1 1 3 4

11. A boy who weighed 104 pounds in June, weighed $\frac{9}{8}$ of that amount the next October. How many pounds had he gained? Diagram.

12. An army marched $15\frac{3}{4}$ miles to the north, $13\frac{1}{2}$ miles northeast and $14\frac{3}{4}$ miles east. How long was the entire march?

13. What is the cost of 364 barrels of apples at $\$4\frac{1}{4}$ a barrel?

14. A grocer made up 170 packages of black pepper, each weighing $\frac{1}{4}$ pound. How many pounds of pepper did he use?

15. A locomotive uses 189 gallons of water in one trip. How much water will be used in 96 trips at that rate?

16. Mr. Winter bought a lot for $1100 and built upon it a house costing $2100. His selling price was a gain of $\frac{1}{8}$. For how much was it sold? Diagram.

17. I have $\$26\frac{3}{4}$ in silver quarters. How many quarters have I?

18. A tub filled with butter weighs $70\frac{1}{4}$ pounds; if empty, $3\frac{7}{8}$ pounds. What is the weight of the butter?

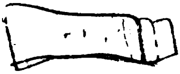
19. A man who had $2790 in bank withdrew $\frac{4}{9}$ of the amount. How much remained in the bank? Diagram.

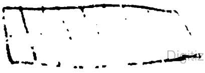
20. One morning a clerk sold the following amounts of linen: $8\frac{1}{8}$ yards, $15\frac{3}{8}$ yards, $26\frac{1}{2}$ yards, $9\frac{3}{4}$ yards. How many yards did he sell in all?

21. A farmer put $40\frac{1}{2}$ pounds of butter into half-pound prints. How many prints had he?

22. On a running track having 4 laps to the mile, a boy ran the first lap in $3\frac{4}{5}$ minutes, the second lap in $3\frac{1}{2}$ minutes, the third lap in $4\frac{2}{5}$ minutes, the fourth lap in $4\frac{3}{4}$ minutes. How long did he take to run the whole mile?

23. Make an original problem about **Bob** and his sled which the class can solve without pencil.





10. *Multiplying by* 10 *and Multiples of* 10.

1. 10 × 6	**2.** 6 × 10	**3.** 20 × 60	**4.** 100 × 60
10 × 16	16 × 10	16 × 30	300 × 60
10 × 23	23 × 10	40 × 25	456 × 20

11. *Reduce — rapid practice:*

1. To twelfths: $\frac{1}{3}$; $\frac{1}{6}$; $\frac{1}{2}$; $\frac{1}{4}$; $\frac{2}{3}$; $\frac{3}{4}$; $\frac{5}{6}$.

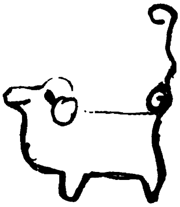
2. To eighths: $\frac{1}{2}$; $\frac{1}{4}$; $\frac{2}{4}$; $\frac{3}{4}$.

3. To tenths: $\frac{1}{5}$; $\frac{4}{5}$; $\frac{1}{2}$; $\frac{3}{5}$; $\frac{2}{5}$.

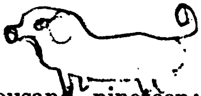
4. To thirds: $\frac{3}{9}$; $\frac{4}{12}$; $\frac{8}{12}$; $\frac{6}{9}$; $\frac{4}{6}$.

5. To fourths: $\frac{2}{8}$; $\frac{3}{12}$; $\frac{9}{12}$; $\frac{6}{8}$; $\frac{4}{8}$; $\frac{6}{12}$.

6. To sixths: $\frac{2}{12}$; $\frac{1}{2}$; $\frac{10}{12}$; $\frac{8}{12}$; $\frac{4}{12}$.



Continue this as a daily exercise until the class has not only accuracy but considerable speed. Make sure before beginning such practice that all pupils in the class can demonstrate the truth of their statements by drawing.



12. *Find the difference between:*

1. Nine million nine hundred one thousand nineteen; and ninety-one thousand nine hundred one.

2. Eight million eighty thousand eight hundred; and eight hundred thousand eight.

3. Six million ninety-six thousand six hundred ninety; and nine hundred sixty thousand ninety-six.

4. Seven million eighty-nine thousand eight hundred; and eight hundred ninety thousand nine hundred eight.

13. *Add and subtract at sight:*

1. $24\frac{2}{3}$	**3.** $61\frac{7}{8}$	**5.** $93\frac{11}{12}$	**7.** $48\frac{6}{7}$	**9.** $85\frac{9}{10}$
$\underline{18\frac{2}{3}}$	$\underline{47\frac{3}{8}}$	$\underline{28\frac{7}{12}}$	$\underline{39\frac{5}{7}}$	$\underline{58\frac{7}{10}}$
2. $62\frac{5}{6}$	**4.** $97\frac{3}{4}$	**6.** $68\frac{8}{9}$	**8.** $75\frac{4}{5}$	**10.** $61\frac{5}{9}$
$\underline{29\frac{4}{6}}$	$\underline{79\frac{1}{4}}$	$\underline{46\frac{7}{9}}$	$\underline{46\frac{2}{5}}$	$\underline{57\frac{2}{9}}$

14. *Meadowbrook Farm: VII — Two Jerseys — Oral.*

1. The children named the two new Jersey cows, Belle and Daisy. Mr. Henderson paid Paul and Henry each $.50 a week for milking and caring for them. How much did each boy make in a year?

2. The boys fed the cows a peck of ground feed each day for 256 days. How many bushels of feed did it take?

3. Each cow ate also $3\frac{1}{4}$ tons of hay worth $36 a ton. What was all the hay worth?

4. The cows gave on an average 6 gallons of milk a day. Mrs. Henderson put the cream to rise in gallon and half-gallon crocks. She used 4 of the former and —— of the latter.

5. A gallon of milk weighs about $8\frac{1}{2}$ pounds. What was the weight of each day's milking?

6. During the month of April Mrs. Henderson made 60 pounds of butter, which brought $.48 a pound. How much was the butter worth?

7. The family used a gallon of milk daily during April. At 15 cents a quart, how much was the milk worth?

8. An agent sold Mrs. Henderson a cream separator which took from each hundred pounds of milk one more pound of cream than she could skim from the crocks. Belle and Daisy together gave 1500 pounds of milk in a month. How much extra cream did Mrs. Henderson get in one month?

9. How much was the extra cream worth at $.50 a pound?

10. Mrs. Henderson paid Elizabeth $.50 a week for helping with the milk and butter. How soon did Elizabeth have $5 to put into the bank?

11. The children thrived on the fresh milk:

a. Paul was 57 inches high when he went to the farm. At the end of the year he had grown $4\frac{3}{4}$ inches. What was his height then?

b. Robert weighed $70\frac{1}{4}$ pounds when he went to the farm. At the end of the year he had increased $7\frac{1}{2}$ pounds. How much did he then weigh?

c. Elizabeth weighed $57\frac{3}{8}$ pounds and increased to $62\frac{5}{8}$ pounds during the year. What was her increase?

Avoirdupois Weight

Complete and learn:

—— ounces make 1 pound.
—— pounds make 1 hundredweight.
—— pounds make 1 ton.
—— hundredweight (cwt.) make 1 ton.

15. *Complete and learn:*

a. 2 × 13 = 26
2 × 14 = 28
to
2 × 50 = 100

b. 100 ÷ 2 = 50
98 ÷ 2 = 49
to
26 ÷ 2 = 13

16. *Written Problems.*

1. A rug is 5¾ feet wide and 9½ feet long. How much greater is its length than its width?

2. My father is 40½ years my elder. I am 10¾ years old. What is my father's age?

3. Mr. Robinson painted ⅜ of his barn yesterday and ⅜ of it to-day. What part has he still to finish?

4. If 30 barrels of flour weigh 5880 pounds, how much will 90 barrels weigh?

5. A flagpole 42 feet long stands $\frac{2}{7}$ of its length in the ground. The part above the ground measures what?

6. A pipe can fill a cistern holding 342 barrels of water in 18 hours. ~~How many~~ barrels does it fill in one hour?

7. Robert is 4⅙ feet tall, and Kate lacks 3 inches of being as tall as Robert. How tall is Kate?

8. In making a dress ruffle 3⅝ inches wide, enough cloth must be allowed to turn in ⅞ inches on one side and 1¼ inches on the other. What is the total width needed?

9. One bushel of shelled corn weighs 56 pounds. How many bushels could be loaded into a car whose capacity is 67,200 pounds?

10. A gardener dug 12,000 pounds of white potatoes from one acre of ground. At this rate, how many pounds can he dig from 3½ acres?

11. A gentleman pays his chauffeur $90 a month. The repairs for his machine cost $750; other expenses are $250. What is the entire expense of running the machine for a year?

12. How many five-inch badges will 40 yards of ribbon make?

13. If one gross of crayons fill a box, how many ~~such~~ boxes will it take for 17,280 crayons?

14. A stenographer receives $75 a month. If her expenses are $650, how much does she save in a year?

15. A commission merchant sold 324 pounds of dressed chickens at 42¼¢ a pound. How much did he receive for them?

42¼) 324

17. *A Multiplication Race.*

x	9	5	7	3	6	2	1	8	4
8	72	40	56	24	48	16	8	64	32
4	36	20	28			etc.			

Write the nine digits out of numerical order across the top of a piece of squared paper, and down the left side. Use the top row for multiplicands and the left-hand column for multipliers. The pupils should stand on the floor in the order in which they finish, the one finishing first taking first rank. Continue daily until the majority of the class can write the answers in $1\frac{3}{4}$ minutes. Make accuracy the first requisite.

18. *Find the quotient:*

1. 1,586,335 ÷ 196
2. 1,263,191 ÷ 178
3. 1,908,006 ÷ 195
4. 1,258,697 ÷ 186
5. 1,365,249 ÷ 149
6. 1,286,991 ÷ 189
7. 1,053,337 ÷ 157
8. 1,443,976 ÷ 169

19. *Add:*

1.	**2.**	**3.**	**4.**	**5.**	**6.**
877	875	538	998	964	973
875	969	477	444	654	759
834	791	863	967	767	988
455	777	276	975	467	242
785	756	462	744	195	647
949	384	555	796	915	954
162	626	465	714	866	195
598	475	659	377	935	775
876	398	538	585	597	969
987	865	897	986	758	964

20. *Find the product:*

1. 7968 × 489
2. 6976 × 978
3. 9738 × 486
4. 8769 × 368
5. 7896 × 639
6. 8997 × 697

21. *Meadowbrook Farm: VIII — Two Jerseys (continued) — Written.*

1. Find the yield of milk for each cow:

	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Belle:	760	758	764	772	753	698	646	640	560	540
Daisy:	782	774	760	710	684	680	648	620	600	540

2.† The milk yielded $\frac{1}{25}$ of its weight in butter fat. How much did Mrs. Henderson receive for this at $.50 a pound?

3. The second year, Mrs. Henderson separated her cream. From each gallon of milk she received $\frac{1}{2}$ pound of cream. If she averaged 5 gallons of milk each day during July, how much did all of the cream weigh?

4. The skim milk which she fed to the pigs was worth $\$7\frac{1}{4}$ a month. How much did it amount to in 10 months?

5. When Mr. Henderson went to the farm he paid $54 for a cow which belonged on the place. Why did he sell her at the end of 3 months? Mrs. Henderson had sold 27 pounds of butter at $.48 a pound. Mr. Henderson said it had cost $6 a month to keep her.

6. Mr. Henderson sold the scrub cow to a butcher for $\frac{1}{9}$ less than he paid for her. What was the sale price? Diagram.

7. Write an original problem about Belle and Daisy.

22. *Written Dictation.*

1. What is $\frac{5}{4}$ of 24?

2. $2\frac{1}{2} - 1\frac{1}{4} = ?$

3. Reduce $\frac{3}{4}$ to 12ths.

4. Morris has a book of 250 pages to read. He has read $\frac{3}{5}$ of the book. How many pages has he yet to read?

5. William had $1.25 in his purse. He spent 75 cents for a pair of gloves. How much had he left?

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† See Table of Contents.

23. *Find the product:*

1. $\begin{array}{r}693\\ \underline{75\frac{1}{3}}\end{array}$ **3.** $\begin{array}{r}876\\ \underline{59\frac{1}{6}}\end{array}$ **5.** $\begin{array}{r}972\\ \underline{45\frac{1}{4}}\end{array}$ **7.** $\begin{array}{r}894\\ \underline{65\frac{1}{7}}\end{array}$ **9.** $\begin{array}{r}882\\ \underline{48\frac{1}{9}}\end{array}$

2. $\begin{array}{r}518\\ \underline{58\frac{1}{7}}\end{array}$ **4.** $\begin{array}{r}365\\ \underline{85\frac{1}{5}}\end{array}$ **6.** $\begin{array}{r}972\\ \underline{43\frac{1}{6}}\end{array}$ **8.** $\begin{array}{r}848\\ \underline{94\frac{1}{8}}\end{array}$ **10.** $\begin{array}{r}791\\ \underline{73\frac{1}{7}}\end{array}$

> Things to which a number is applied form a quantity, as 3 eggs, 2 bushels. A measured or numbered quantity is sometimes called a concrete number, while the number itself is called abstract. 7 apples is called a concrete number. 7 is called an abstract number.

24. *Suggestive Questions.*

1. Which number is the multiplicand in an example in multiplication? Which is the multiplier? What is the name of the answer?

2. Can the multiplicand be a concrete quantity? Give an example. Can it be an abstract number? Give an example.

3. Can the multiplier be a concrete quantity? Prove your answer. Can it be abstract?

4. Is the product a concrete or an abstract number? Prove your answer.

25. *Complete:*

1. $\frac{1}{3} = \frac{\overset{4}{?}}{12}; \frac{\overset{6}{?}}{18}; \frac{\overset{8}{?}}{24}; \frac{\overset{12}{?}}{36}.$

2. $\frac{2}{3} = \frac{?}{12}; \frac{?}{18}; \frac{?}{24}; \frac{?}{36}.$

Continue with $\frac{1}{4}$ and $\frac{3}{4}$; $\frac{1}{6}$ and $\frac{5}{6}$; etc.

26. *Add and subtract at sight:*

1. $\begin{array}{r}5\frac{3}{4}\\ \underline{2\frac{1}{2}}\end{array}$ **2.** $\begin{array}{r}7\frac{7}{9}\\ \underline{3\frac{1}{3}}\end{array}$ **3.** $\begin{array}{r}8\frac{2}{3}\\ \underline{4\frac{1}{6}}\end{array}$ **4.** $\begin{array}{r}9\frac{7}{12}\\ \underline{5\frac{1}{3}}\end{array}$ **5.** $\begin{array}{r}6\frac{3}{4}\\ \underline{4\frac{5}{12}}\end{array}$

27.* *Multiplication of a Fraction by an Integer — Multiplying the Numerator.*

1. *For study. a.* A toy merchant sold basket-balls for $3 each. How much did he receive for 2 of them? For 4? For 7? For 9?

b. A toy merchant sold dolls' bedsteads at $\$\frac{3}{4}$ each. How much did he receive for 2 of them? For 4? For 7? For 9?

Complete the following:

a. $1 \times \$3 = \$3$
$2 \times \$3 = \$6$
$3 \times \$3 = \$9$
to
$9 \times \$3 = \$27$

b. $1 \times \$\frac{3}{4} = \$\frac{3}{4}$
$2 \times \$\frac{3}{4} = \$\frac{6}{4}$
$3 \times \$\frac{3}{4} = \$\frac{9}{4}$
to
$9 \times \$\frac{3}{4} = \$\frac{27}{4}$

Leave answers temporarily as improper fractions.

2. *a.* A florist sold tea roses at $4 a dozen. How much did he receive for 3 dozen? For 5 dozen?

b. A florist sold carnations at $\$\frac{4}{5}$ a dozen. How much did he receive for 3 dozen? For 5 dozen?

Write as under problem 1 the multiplication tables for 2 and for $\frac{2}{5}$.

3. A family uses $\frac{5}{8}$ of a pound of butter in one day. How much will it use in 3 days? Write the table for $\frac{5}{8}$.

4. A dressmaker made 5 bows of ribbon, using $\frac{3}{8}$ of a yard of ribbon in each. How many yards did she use in all? Table for $\frac{3}{8}$.

5. If one book costs $\$\frac{3}{5}$, how much will 6 similar books cost? 9 books?

6. John walks at the rate of $\frac{1}{2}$ of a mile in 10 minutes. How far will he walk in one hour?

7. In a schoolroom $\frac{2}{3}$ of a box of chalk was used in one month. How much was used in 12 months?

8. Find the cost of 25 electric globes at $\$\frac{1}{4}$ each.

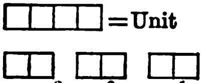
Teacher will please read the Preface and the Table of Contents.
Lessons marked * should be assigned for study previous to the recitation. See Suggestions to Teachers.

28.* *Multiplication of a Fraction by an Integer (continued) — Multiplying the Numerator.*

With squared paper or by drawing illustrate any two of the following:

1. *For study.* $3 \times \frac{2}{4} = ?$

$3 \times \frac{2}{4} = \frac{6}{4}.$



8 x 2/4 = 6/4 or 1 1/2

2. $4 \times \frac{3}{4} = ?$

3. $5 \times \frac{2}{3} = ?$

4. $7 \times \frac{3}{5} = ?$

It will be well to ask the class to demonstrate multiplying a fraction by an integer with squared paper or by drawing before they study the illustration on this page. For those lacking the necessary invention, demonstrate upon the board. Prepare similar tables for other fractions until the class thoroughly grasps the principle.

29. *Suggestive Questions in Fractions.*

1. Write two fractions having the same denominator. Which is the greater? Write two fractions of unequal value having the same numerator. Which is the greater?

2. How many fourths in $2\frac{1}{2}$? Your answer is what kind of fraction?

3. Name the fraction whose numerator is 12 and whose denominator is 8. To what mixed number is it equal?

4. What do you understand by $\frac{3}{4}$ of an acre?

5. Which expresses the larger parts: $\frac{4}{10}$ or $\frac{3}{5}$? Which expresses the larger number of parts? Which expresses the larger value?

> A fraction is said to be in its lowest terms when the numerator and the denominator cannot be divided by the same number. For example, $\frac{6}{9}$ is not in its lowest terms; $\frac{5}{9}$ is in its lowest terms.

6. Which of the following fractions are in their lowest terms: $\frac{9}{12}$; $\frac{5}{8}$; $\frac{5}{10}$; $\frac{8}{9}$; $\frac{7}{10}$; $\frac{8}{10}$; $\frac{7}{12}$? Reduce the others to their lowest terms.

30. *Written Problems.*

1. A boy spent $\frac{1}{2}$ of an hour studying arithmetic, $\frac{3}{4}$ of an hour studying geography, and $\frac{5}{6}$ of an hour making a drawing. How much time did he spend at ~~all his~~ work?

2. A pane ~~of glass~~ $10\frac{3}{8}$ inc~~hes wide and~~ 14 ~~inches~~ long is cut from a larger piece ~~which~~ is 13 inches wide ~~and 17~~ inches long. Find the greatest ~~length~~ and the greatest width of the piece ~~left~~ over. Drawing.

3. An automobile travels $\frac{3}{5}$ as fast as a train. How far can the automobile travel in the time that the train takes to go 185 miles?

4. A machine polishes 6 pencils a minute. How many will it polish in $2\frac{1}{2}$ hours?

5. In making a desk 15 ~~inches wide~~ a carpenter uses 2 boards, one $7\frac{3}{8}$ inches wide and the other $9\frac{1}{2}$ inches wide. How wide a strip must be cut from one of the boards to get the proper width?

6. A trolley company pays a motorman \$5.50 a day and a conductor $\frac{9}{10}$ as much. How much does the conductor receive per day?

7. In a factory ~~the number of~~ men employed is $3\frac{1}{2}$ times as great as the number of boys. If there are 84 boys, how many men are employed?

8. There are 320 barrels of sugar on a boat; $\frac{7}{8}$ of them contain white sugar; the remainder brown sugar. Find the number of barrels of each kind.

9. A number of workmen are laying 1200 yards of track for a trolley road. After they have completed $768\frac{3}{4}$ yards, how many yards remain to be laid?

10. An express wagon carried packages that weighed 750 pounds. After some of the packages had been delivered, the load was only $\frac{7}{10}$ as heavy as at first. How heavy were the packages that had been delivered?

11. A train travels $22\frac{1}{4}$ miles faster each hour than a steamboat. How much farther than the boat does the train travel in 7 hours?

12. One store charged 48¢ a pound for turkey. Another store charged only 46¢ a pound. How much was saved by buying at the cheaper price three turkeys that weigh $12\frac{1}{2}$ pounds each? Two ways.

13. If a family uses $1\frac{1}{4}$ pounds of butter a day, how many pounds will it use during the month of June?

14. From a piece of wire $92\frac{1}{3}$ inches long, three pieces each $16\frac{1}{2}$ inches long were cut. How many inches of wire were left?

15. An express train travels at the rate of $42\frac{1}{4}$ miles an hour. A slower train travels at the rate of $35\frac{3}{8}$ miles an hour. How much farther does the first train go in an hour than the second?

16. The cover of a box is made of 3 pieces of wood. The pieces are $3\frac{5}{8}$ inches wide, $4\frac{3}{4}$ inches wide, and $5\frac{5}{6}$ inches wide, respectively. Find the width of the cover.

17. The amount of freight carried by a railroad is now $3\frac{3}{4}$ times as great as before. If the railroad formerly earned $180,400 in freight charges, how much does it earn now?

18. If an airplane flies 96 miles an hour, how far will it fly in $5\frac{3}{4}$ hours?

19. The receipts of a store for a week are $1740. Of this amount $\frac{4}{10}$ is paid for merchandise, $\frac{1}{10}$ for rent, and $\frac{1}{5}$ for clerk hire. The rest is profit. How much is profit?

20. A bolt of cloth contains $32\frac{3}{4}$ yd. From it two pieces, one containing $10\frac{5}{8}$ yd. and the other containing $16\frac{1}{2}$ yd., are sold at $2.50 a yard. How much is received for the cloth sold? How much is the remainder of the cloth worth?

21. The total receipts of a baseball game were $993.60. Of this amount $\frac{7}{8}$ was divided equally among the 9 players. How much money did each one receive?

22. How many yards of ribbon would be needed to make 12 bags, if $1\frac{3}{4}$ yards are used for each bag?

31. *Ratio. — Solve in two ways — Oral.*

When oranges are 48¢ a dozen, what will be the cost of:

1. 4 oranges?
2. 18 oranges?
3. 5 oranges?
4. 15 oranges?
5. 16 oranges?
6. 28 oranges?
7. 9 oranges?
8. 10 oranges?
9. 27 oranges?
10. 48 oranges?
11. 60 oranges?
12. 72 oranges?

Continue exercises of this type at frequent intervals. Insist upon solution by ratio where possible, after the pupil understands solution by unitary analysis.

32. *Find the sum:*

1. $\begin{array}{r}69\frac{3}{10}\\47\frac{4}{5}\\56\frac{1}{2}\\38\frac{3}{5}\\\hline\end{array}$
2. $\begin{array}{r}45\frac{7}{10}\\83\frac{1}{2}\\52\frac{3}{5}\\61\frac{9}{10}\\\hline\end{array}$
3. $\begin{array}{r}86\frac{5}{9}\\98\frac{1}{3}\\65\frac{7}{9}\\87\frac{2}{3}\\\hline\end{array}$
4. $\begin{array}{r}45\frac{3}{8}\\69\frac{1}{2}\\97\frac{1}{4}\\68\frac{1}{8}\\\hline\end{array}$
5. $\begin{array}{r}76\frac{2}{3}\\85\frac{5}{6}\\18\frac{1}{2}\\75\frac{1}{3}\\\hline\end{array}$
6. $\begin{array}{r}98\frac{8}{9}\\72\frac{2}{3}\\59\frac{7}{9}\\87\frac{1}{3}\\\hline\end{array}$
7. $\begin{array}{r}92\frac{7}{8}\\43\frac{3}{4}\\56\frac{5}{8}\\84\frac{1}{2}\\\hline\end{array}$
8. $\begin{array}{r}67\frac{1}{2}\\46\frac{2}{3}\\27\frac{5}{6}\\95\frac{1}{3}\\\hline\end{array}$

33. *Find the difference:*

1. $\begin{array}{r}63\frac{1}{2}\\27\frac{7}{8}\\\hline\end{array}$
2. $\begin{array}{r}92\frac{1}{3}\\57\frac{5}{9}\\\hline\end{array}$
3. $\begin{array}{r}81\frac{1}{3}\\39\frac{7}{9}\\\hline\end{array}$
4. $\begin{array}{r}31\frac{1}{2}\\17\frac{6}{5}\\\hline\end{array}$
5. $\begin{array}{r}70\frac{1}{3}\\46\frac{1}{2}\\\hline\end{array}$
6. $\begin{array}{r}83\frac{1}{4}\\59\frac{3}{8}\\\hline\end{array}$
7. $\begin{array}{r}64\frac{1}{4}\\18\frac{5}{8}\\\hline\end{array}$
8. $\begin{array}{r}65\frac{1}{3}\\48\frac{5}{6}\\\hline\end{array}$

34. *At sight:*

1. $\frac{2}{3} \times 18$ $\frac{3}{2} \times 18$
2. $\frac{3}{4} \times 12$ $\frac{4}{3} \times 12$
3. $\frac{5}{6} \times 30$ $\frac{6}{5} \times 30$
4. $\frac{3}{8} \times 24$ $\frac{8}{3} \times 24$
5. $\frac{2}{9} \times 18$ $\frac{9}{2} \times 18$
6. $\frac{3}{10} \times 30$ $\frac{10}{3} \times 30$
7. $\frac{5}{7} \times 35$ $\frac{7}{5} \times 35$
8. $\frac{4}{9} \times 36$ $\frac{9}{4} \times 36$

The sign × following a fraction is usually read "of."

88
60
5280

35. *At the Meat Market — dramatize.*

Beef — rib roast
— pot roast
— shoulder
— tongue
— tenderloin
— sirloin steak
— porterhouse steak
— sweet breads

Lamb — hind quarter
— chops
Pork — ham
— sausage
— tenderloin
— bacon
Fish — white
— mackerel
— oysters

Chicken
Duck

Turkey
Squab

Obtain prices from market reports or from local shops. Secure also a sample sales check, and have pupils make a quantity for their own use. Employ several clerks, one of whom shall make change and check up sales. Use toy money. Encourage conversation about the quality of meat. Give instruction in business courtesy. An excursion to a meat market would prove highly advantageous.

1st customer: 3 qt. oysters; 3½ lb. rib roast.
2d customer: 2½ lb. white fish; 3¼ lb. beef shoulder.
3d customer: 3¾ lb. pork tenderloin; 2 lb. sausage.
4th customer: 3½ lb. bacon; 2¼ lb. sirloin steak.
5th customer: 3½ lb. hind quarter lamb; 3 lb. duck.

36. *Multiply without pencil:*

1. *For study:*

$6 \times 46 = ?$

Think: $6 \times 40 = 240$

$6 \times 6 = 36$

Say: $240 + 36 = 276$

2. $9 \times 72 = ?$

3. $7 \times 85 = ?$

4. $8 \times 43 = ?$

5. $5 \times 97 = ?$

37. *Oral Problems.*

1. If 2 men can dig $\frac{3}{4}$ of an acre of potatoes in one day, how many acres can they dig in 5 days?

2. Two and one half gallons of milk will supply how many children with a half pint each?

3. If bread requires 1 pint of liquid for every three pounds of flour, how much liquid will be required if 18 pounds of flour are used?

4. A certain kind of flour weighs $\frac{5}{6}$ as much as the wheat from which it is made. How many pounds of this flour can be made from 30 pounds of wheat?

5. If it takes 40 minutes to roast a piece of beef, at what time should it be put into the oven to be ready to serve at 6 P.M.?

6. A certain brand of pork and beans is sold at 35 cents a can or 3 cans for one dollar. How much is saved by buying 6 cans at once?

7. Mrs. Mills cut 3 pies into sixths and served 14 people. How many pieces had she left? What part of the whole had she left?

8. At the lake one season 840 white fish were caught. Of these $\frac{3}{4}$ were shipped away. How many fish remained?

9. It is 18 miles to Beaver Brook. Elmer's tire is punctured after he has ridden $\frac{5}{9}$ of the way. How far must he walk to reach the brook?

37

10. Melvin's father raised 160 bushels of wheat and $\frac{3}{10}$ as much oats. How many bushels of oats did he raise?

11. A laborer is plowing a 10-acre field. He has plowed $4\frac{5}{8}$ acres. How many acres has he yet to plow?

12. Mrs. Brooks bought a roast weighing $5\frac{1}{2}$ pounds and a steak weighing $2\frac{3}{4}$ pounds. Combined weight?

13. Which is the cheaper in two years, to buy shoes costing $8 that will wear 6 months, or $12 shoes that will wear 8 months? How much?

14. If 20 apple trees have an average yield of $8\frac{1}{4}$ bushels, how many bushels are there in all? 25

15. If 3 men can build a wall in 9 days, how long would it take one man to build it?

16. A farmer drove to market with a load of vegetables, going a distance of $10\frac{1}{2}$ miles. As his wagon was light, he returned by the hill road, a distance of $9\frac{3}{4}$ miles. How far did he drive altogether?

17. When should a turkey that will require 3 hours 30 minutes to roast, be put into the oven to be ready to serve at 1 P.M.?

18. It takes Frank 12 minutes to walk to school. He usually runs home at noon and at night because he is hungry, making the trip in 8 minutes. How long do the 4 trips take him each day?

19. If Frank lives $6\frac{1}{4}$ blocks from school, how far does he go in the 4 trips? If 10 blocks make one mile, how many miles does he go?

20. What is the price of 5 cauliflowers at $\$\frac{6}{20}$ each?

21. Mark paid $1.20 for replacing the sash in a window that he had broken. This was $\frac{1}{3}$ of all the money he had in his bank. How much money remained?

22. How wide must a box be to accommodate 6 lead pencils laid on the bottom, if each has a diameter of $\frac{3}{8}$ of an inch?

38. *Multiplication of a Fraction by an Integer (continued): Multiplying the Numerator.*

Write out the following, using this form:

See pp. 78, 79 for previous lessons.

1. $2 \times \frac{3}{4} = \frac{2 \times 3}{4} = \frac{6}{4} = 1\frac{1}{2}$.

2. $5 \times \frac{2}{3}$

3. $6 \times \frac{4}{5}$

4. $8 \times \frac{4}{7}$

5. $6 \times \frac{5}{6}$

6. $6 \times \frac{7}{10}$

7. $9 \times \frac{3}{8}$

8. $8 \times \frac{3}{5}$

9. $9 \times \frac{2}{3}$

Complete and learn:

To multiply a fraction by an integer multiply the —— of the fraction by the integer.

39. *At sight:*

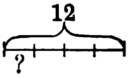
1. $\frac{1}{4}$ of 12 = ?
12 is $\frac{1}{4}$ of ?
$\frac{1}{3}$ of 9 = ?
9 is $\frac{1}{3}$ of ?

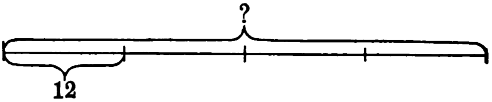
2. $\frac{1}{3}$ of 18 = ?
18 is $\frac{1}{3}$ of ?
$\frac{1}{4}$ of 16 = ?
16 is $\frac{1}{4}$ of ?

3. $\frac{1}{5}$ of 30 = ?
30 is $\frac{1}{5}$ of ?
$\frac{1}{4}$ of 24 = ?
24 is $\frac{1}{4}$ of ?

Make diagrams illustrating any pair of the above as:

$\frac{1}{4}$ of 12 = ? and 12 is $\frac{1}{4}$ of ?





40. *Find the difference between:*

1. Ten million one thousand; and one hundred thousand one.

2. Nine million ninety thousand; and ninety thousand nine hundred.

3. Seven hundred thousand; and seven thousand seven hundred.

4. Seven million six hundred twenty-seven thousand forty; and ninety-six thousand eight hundred seventy-five.

41.* *Multiplication of a Mixed Number by an Integer.*

See pp. 78, 79 and 86 for previous lessons.

1. *For study.*

a. $3 \times 2 = 6$

$3 \times \frac{1}{2} = 1\frac{1}{2}$

$3 \times 2\frac{1}{2} = 7\frac{1}{2}$

b. $3 \times 2\frac{1}{2} = ?$

$2\frac{1}{2} = \frac{5}{2}$

$3 \times \frac{5}{2} = \frac{15}{2}$ or $7\frac{1}{2}$

2. $3 \times 1\frac{2}{3}$
3. $6 \times 2\frac{1}{3}$
4. $7 \times 1\frac{1}{4}$
5. $5 \times 1\frac{3}{8}$
6. $4 \times 2\frac{3}{5}$
7. $2 \times 1\frac{5}{7}$
8. $5 \times 2\frac{2}{3}$

9. $9 \times 1\frac{2}{3}$
10. $4 \times 3\frac{1}{2}$
11. $6 \times 3\frac{1}{4}$
12. $5 \times 2\frac{3}{7}$
13. $8 \times 1\frac{7}{8}$
14. $3 \times 5\frac{1}{2}$
15. $7 \times 2\frac{1}{6}$

42. *Written Dictation.*

1. Write in words 96,049.

2. How many quarts are there in $2\frac{3}{4}$ pecks?

3. A bag of coffee weighed 96 pounds. How much did it weigh after 17 pounds had been sold?

4. How much will it cost to sod a front lawn 2 feet wide and 35 feet long at 3 cents a square foot?

5. A rabbit which weighed $1\frac{1}{2}$ pounds gained $\frac{3}{4}$ of a pound in 6 months. How much did it then weigh?

43. *Who'll Buy a Balloon?*

A class is divided into two groups, boys against girls.

The balloon man holds up a card bearing an example, as $\boxed{4 \times \frac{3}{7}}$.

The child who calls the correct answer first gets the balloon.

This game can be used for the other three processes as well.

44. *Written Problems.*

1. From a plank 16 feet long was cut a piece $2\frac{1}{4}$ feet long. What is the length of the remaining piece?

2. Mr. McConnell owns a farm of 40 acres. One year he rented it at $18.50 an acre. The next year he rented it for $\frac{1}{2}$ of the corn crop which sold for $975. Which was the more profitable year? 40 x 18.50 $\frac{1}{2}$

3. A telephone pole $25\frac{1}{4}$ feet above ground is $4\frac{3}{8}$ feet in the ground. How many feet long is it? 25¼ +

4. Count your pulse for one minute. At this rate how many times does it beat in one hour?

5. Cuba has an area of forty-five thousand eight hundred eighty-four square miles and that of the Philippines is one hundred fourteen thousand four hundred ten square miles. What is the difference between their areas?

6. If telegraph wire weighs 500 pounds per mile, how many pounds will it take to stretch a wire from Cincinnati to Chicago, a distance of 298 miles?

7. A firm manufacturing automobile tires sent out 10,000 advertising letters. It was estimated that $\frac{6}{10}$ of the letters would be read and that $\frac{1}{3}$ of that number would be answered. How many answers were expected?

8. Robert had 652 marbles in a box. Of these $\frac{1}{4}$ were agates and the rest were crystals. How many crystals were in the box?

9. A dressmaker had two pieces of cloth containing $7\frac{1}{3}$ yards and $9\frac{3}{4}$ yards respectively. In making a dress she used $11\frac{1}{6}$ yards. How much cloth was left?

10. Required the cost of 210 barrels of apples when 3 barrels cost $15.

11. In drying, some apples lost $\frac{5}{8}$ of their weight. How many pounds of dried apples would be realized from 218 pounds of apples if this proportion holds true? Diagram.

12. One Saturday, Roscoe whitewashed the back and side fences. At noon he had finished $37\frac{3}{8}$ yards and still had $7\frac{3}{4}$ yards to do. How many yards of fencing were there?

13. A man who spent on the average 10 cents a day for cigars, decided to save the money. Tell two valuable things he could buy with the money at the end of the year and the cost of each. Make your problem one in fractions.

14. A lady's coat has 10 buttonholes on it, set $2\frac{3}{4}$ inches apart. How long is the row?

15. On the day before Christmas, I mailed three packages at the post office. The first weighed 12 ounces, the second 8 ounces and the last $1\frac{1}{2}$ pounds. How much did they all weigh? Use fractions in your solution.

16. Mr. Kessler has a garden containing 36 square yards. He has $\frac{4}{9}$ of it planted in beans, $\frac{1}{3}$ of it in peas and the rest in cabbage. What part of the garden is in cabbage? How many square yards? Diagram.

17. In a recitation 42 questions were asked. Of these $\frac{4}{7}$ were answered correctly. How many questions were incorrectly answered? Diagram.

18. When the minuend is 145,876 and the remainder is 98,765, what is the subtrahend?

45. *Reduce to improper fractions:*

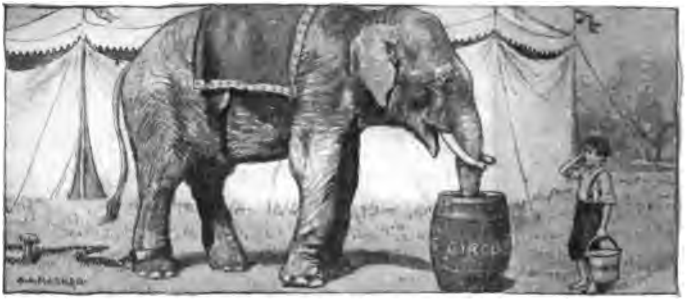
1. $17\frac{3}{4}$
2. $56\frac{5}{6}$
3. $49\frac{2}{5}$
4. $65\frac{5}{12}$
5. $49\frac{7}{13}$
6. $26\frac{5}{8}$
7. $38\frac{2}{3}$
8. $27\frac{4}{5}$
9. $47\frac{7}{18}$
10. $81\frac{4}{15}$
11. $45\frac{4}{9}$
12. $27\frac{3}{7}$
13. $85\frac{7}{9}$
14. $92\frac{5}{11}$
15. $78\frac{5}{19}$

46. *Reduce to mixed numbers:*

1. $\frac{129}{5}$
2. $\frac{459}{7}$
3. $\frac{605}{3}$
4. $\frac{463}{4}$
5. $\frac{509}{8}$
6. $\frac{279}{6}$
7. $\frac{765}{9}$
8. $\frac{350}{6}$
9. $\frac{390}{7}$

47. *Seeing Number all about Us.*

Make two original problems suggested by the picture. Make the problems of such difficulty that one will require a pencil for its solution and the other will not.



48. *Find the quotient:*

1. 170,803 ÷ 128	**6.** 633,947 ÷ 139
2. 714,943 ÷ 197	**7.** 118,626 ÷ 147
3. 119,843 ÷ 176	**8.** 937,518 ÷ 189
4. 837,727 ÷ 138	**9.** 124,185 ÷ 156
5. 416,872 ÷ 157	**10.** 721,654 ÷ 168

49. *Complete and learn:*

a. 3 × 13 = 39	*b.* 91 ÷ 13 = 7	*c.* 91 ÷ 7 = 13
4 × 13 = 52	78 ÷ 13 = 6	78 ÷ 6 = 13
to	to	to
7 × 13 = 91	39 ÷ 13 = 3	39 ÷ 3 = 13

50. *Table of Time.*

Complete and learn:

—— seconds make 1 minute.
—— minutes make 1 hour.
—— hours make 1 day.
—— days make 1 week.
—— days make 1 year.
—— days make 1 leap year.

—— days have September,
April, June, and November.
All the rest have —
Save February, which alone
Has ——, and one day more
We add to it one year in four.

51.* *Division of a Fraction by an Integer — Dividing the Numerator.*

1. *For study.* *a.* If 6 bushels of potatoes fill 2 bags of equal size, how much does each bag hold?

Solution

6 bu. ÷ 2 = 3 bu.

One bag holds 3 bushels.

b. If $\frac{6}{8}$ of a bushel of peaches fill 2 baskets of equal size, how much does each basket hold?

Solution

$\frac{6}{8}$ bu. ÷ 2 = $\frac{6 \div 2}{8} = \frac{3}{8}$ bu.

One basket holds $\frac{3}{8}$ bushel.

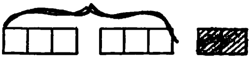
2. Lucy had $\frac{8}{12}$ of a yard (24 inches) of linen which she cut into 2 equal pieces for handkerchiefs. How long was each piece? Integers and fractions.

3. Robert is awake $\frac{15}{24}$ of his time. He plays $\frac{1}{3}$ of the time he is awake. What part of all his time does he play? Integers and fractions.

4. A boy who worked 2 hours received \$$\frac{8}{20}$. How much was that per hour?

5. Show with squared paper or by drawing any two of the following:

a. *For study.* $\frac{6}{8} \div 2 = \frac{3}{8}$.



b. $\frac{8}{9} \div 4 = ?$

c. $\frac{9}{14} \div 3 = ?$

d. $\frac{6}{7} \div 2 = ?$

e. $\frac{6}{7} \div 3 = ?$

6. If $\frac{15}{16}$ of an acre is divided into 5 lots of equal size, how large is each lot?

7. Uncle Joshua whitewashed both sides of his back fence and used $\frac{8}{9}$ of a bushel of lime. How much did he use on one side?

8. Complete the following:

a. 36 ÷ 3 = 12
33 ÷ 3 = 11
to
3 ÷ 3 = 1

b. $\frac{36}{5} \div 3 = \frac{12}{5}$
$\frac{33}{5} \div 3 = \frac{11}{5}$
to
$\frac{3}{5} \div 3 = \frac{1}{5}$

NOTE: All problems on this page are problems in partition.

52. *The Laundry — Oral.*

Aprons	15¢	*Pillow Slips*	4¢
Collars	4¢	*Sheets*	8¢
Cuffs, per pair	7¢	*Shirts*	25¢
Handkerchiefs	3¢	*Shirt Waists*	35¢
Hose	7¢	*Spreads*	25¢
Lace Curtains	50¢	*Table Cloths*	25¢
Napkins	3¢	*Towels*	5¢

1. What is the amount of Mrs. Lodge's bill:
4 sheets, 2 pillow slips, 6 napkins, 2 tablecloths, 2 aprons?

2. Mr. White sent the following articles to the laundry during one week in February: 6 collars; 6 pairs of cuffs; 10 handkerchiefs; 4 shirts. What was his laundry bill?

3. The Adams Hotel sent 2 dozen lace curtains. On account of the large order the work was done at $\frac{1}{12}$ less than the list price. How much was the bill?

4. The same hotel sent 300 lb. of sheets and pillow slips. At 9¢ a lb. rough dry, what was this second bill?

5. A City Swimming Pool sent 500 lb. of towels at 9¢ a lb. If a towel weighed 4 oz., how many towels were laundered? Do you see another problem?

6. Is it customary for customers with large orders to get reduced prices? Is it fair that they should? Why?

7. Mrs. Herron sent 2 spreads, 1 doz. napkins, 3 aprons, 7 towels, 5 sheets, 2 tablecloths, 4 pillow slips, 3 shirtwaists, $1\frac{1}{2}$ doz. handkerchiefs and 2 pr. of lace curtains. What was the amount of her bill?

8. A hospital sent the following articles: 250 lb. of sheets, 200 lb. of towels, 16 doz. napkins and 150 lb. of pillow slips. How much was the bill?

It will be well for pupils to bring in several of the common laundry lists furnished to customers. Include in the original problems some calculation of what is known as "flat work."

53. *Meadowbrook Farm: IX — The Orchard.*

1. Mr. Henderson decided to plant one acre of his farm in apples. He drew a plan of the orchard 10 rods wide and 16 rods long to the scale of $\frac{1}{2}$ inch to the rod. Draw such a rectangle. How many feet long and how many feet wide is the acre you have represented?

2. He then divided the rectangle into inch squares and drew the diagonals of each square. Where the diagonals crossed he drew a ring to show where he planned to set a tree. Do this. How many trees did he plant? How far apart are they?

3. How much did he pay for his trees at $27 a hundred?

4. Mr. Henderson employed a man with a team for $2\frac{1}{2}$ days to help him prepare the ground and plant the orchard. How much did he pay the man at $7.50 a day?

5. After the trees began to bear, the first year's yield was 90 barrels, which were worth $4.50 a barrel. If it cost him $2.25 to produce a barrel, what was his profit?

6. Mr. Henderson sold $\frac{14}{15}$ of his fruit. How much money did he receive from the part sold?

7. Between the trees he planted 84 currant bushes, which yielded 3 quarts to the bush. The cost of the bushes and cultivation he estimated at 40¢ each. If he sold $\frac{3}{4}$ of his crop at 25¢ a quart, how much did he clear on the currants?

54.* *Division by a Fraction.*

1. *For study.* *a.* Edith used 2 lb. 4 oz. of sugar in making cakes for a fair, using 12 oz. of sugar in each cake. How many cakes did she make?

Solution by Integers

2 lb. 4 oz. = 36 oz.
36 oz. ÷ 12 oz. = 3 times.
Edith made 3 cakes.

b. Edith used $2\frac{1}{4}$ lb. of sugar in making cakes for the fair. She used $\frac{3}{4}$ lb. in each. How many cakes did she make?

Solution by Fractions

$2\frac{1}{4}$ lb. = $\frac{9}{4}$ lb.
$\frac{9}{4}$ lb. ÷ $\frac{3}{4}$ lb. = 3 times.
Edith made 3 cakes.

Complete and learn:

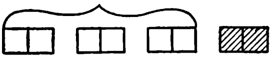
A number can be divided only by another number of the same ——.

2. Uncle William divided $2.40 equally among us children. He gave $\$\frac{3}{5}$ to each of us. How many children were there? Integers and fractions.

3. If tea is sold at $\$\frac{4}{5}$ a pound, how many pounds will $4 buy? Integers and fractions.

4. Show by squared paper or by drawing any two of the following:

a. *For study.* $\frac{6}{8} \div \frac{2}{8} = 3$ times.



b. $\frac{4}{9} \div \frac{2}{9} = ?$
c. $\frac{9}{16} \div \frac{3}{16} = ?$
d. $\frac{10}{13} \div \frac{5}{13} = ?$
e. $\frac{10}{13} \div \frac{2}{13} = ?$

5. *Complete the following:*

a. $1 \times \frac{2}{5} = \frac{2}{5}$
$2 \times \frac{2}{5} = \frac{4}{5}$
to
$12 \times \frac{2}{5} = \frac{24}{5}$

b. $\frac{24}{5} \div \frac{2}{5} = 12$ times.
$\frac{22}{5} \div \frac{2}{5} = 11$ times.
to
$\frac{2}{5} \div \frac{2}{5} = 1$ time.

Prepare similar tables for other fractions until the class thoroughly grasps the principle.

55. *Find the sum:*

1.
$469\frac{3}{4}$
$857\frac{1}{2}$
$698\frac{7}{8}$
$479\frac{1}{4}$
$978\frac{5}{8}$
$676\frac{1}{2}$

2.
$876\frac{1}{4}$
$954\frac{5}{16}$
$879\frac{3}{8}$
$695\frac{3}{4}$
$457\frac{1}{2}$
$498\frac{7}{16}$

3.
$969\frac{2}{3}$
$785\frac{5}{6}$
$587\frac{1}{4}$
$694\frac{5}{12}$
$872\frac{3}{4}$
$295\frac{1}{2}$

4.
$572\frac{1}{3}$
$498\frac{2}{5}$
$798\frac{7}{15}$
$947\frac{2}{3}$
$987\frac{3}{5}$
$894\frac{9}{15}$

5.
$875\frac{4}{5}$
$693\frac{7}{10}$
$785\frac{1}{2}$
$496\frac{9}{10}$
$759\frac{3}{5}$
$875\frac{3}{10}$

6.
$389\frac{3}{8}$
$965\frac{1}{2}$
$473\frac{5}{6}$
$984\frac{3}{4}$
$697\frac{7}{8}$
$798\frac{1}{2}$

56. *Divide:*

1. $3\frac{1}{3}$ by $\frac{2}{3}$
2. $2\frac{2}{5}$ by $\frac{2}{5}$
3. $2\frac{1}{4}$ by $\frac{3}{4}$
4. $5\frac{1}{3}$ by $\frac{2}{3}$
5. $6\frac{2}{3}$ by $1\frac{2}{3}$
6. $5\frac{3}{5}$ by $\frac{2}{5}$
7. $6\frac{1}{4}$ by $1\frac{1}{4}$
8. $9\frac{1}{3}$ by $2\frac{1}{3}$
9. $8\frac{1}{3}$ by $1\frac{2}{3}$
10. $3\frac{3}{5}$ by $\frac{3}{5}$
11. $5\frac{1}{4}$ by $\frac{3}{4}$
12. $3\frac{3}{4}$ by $1\frac{1}{4}$
13. $6\frac{3}{4}$ by $\frac{3}{4}$
14. $7\frac{1}{5}$ by $\frac{4}{5}$
15. $8\frac{3}{4}$ by $1\frac{3}{4}$

57. *Give product at sight:*

1. $4 \times \frac{3}{7}$
2. $5 \times \frac{6}{9}$
3. $7 \times \frac{5}{8}$
4. $6 \times \frac{7}{8}$
5. $3 \times 2\frac{1}{2}$
6. $2 \times 3\frac{1}{2}$
7. $5 \times 1\frac{2}{5}$
8. $7 \times 3\frac{1}{3}$
9. $6 \times 2\frac{1}{3}$
10. $4 \times 3\frac{3}{4}$
11. $3 \times 9\frac{1}{2}$
12. $8 \times 4\frac{1}{5}$
13. $8 \times 2\frac{1}{4}$
14. $7 \times 3\frac{2}{3}$
15. $9 \times 1\frac{4}{5}$
16. $5 \times 2\frac{1}{2}$

58. *Divide at sight:*

1. $3\overline{)630\frac{9}{11}}$
2. $2\overline{)838\frac{4}{7}}$
3. $8\overline{)248\frac{8}{12}}$
4. $4\overline{)484\frac{8}{13}}$
5. $3\overline{)369\frac{6}{7}}$
6. $9\overline{)387\frac{9}{15}}$
7. $2\overline{)426\frac{2}{9}}$
8. $7\overline{)427\frac{14}{18}}$
9. $5\overline{)425\frac{10}{11}}$
10. $5\overline{)550\frac{5}{16}}$
11. $6\overline{)486\frac{12}{13}}$
12. $4\overline{)524\frac{8}{9}}$

59. *Meadowbrook Farm: X — The Orchard (continued) — Oral.*

1. Mr. Henderson paid $38 for 40 trees. What was the price per tree?

2. After planting his young trees, Mr. Henderson trimmed each one back about $\frac{3}{8}$ of its height. What was then the height of the trees that were originally 32 inches? 40 inches? 48 inches?

3. If it cost 72 cents to spray each tree in the orchard, what was the bill for the entire orchard?

4. The first year the entire expense for preparing the ground was $56. The next year it was $\frac{3}{4}$ of that amount. How much was the bill for the two years?

5. Of the 40 trees, $\frac{1}{20}$ died. How many trees lived?

6. What was the real price of each tree that lived?

7. He replaced the dead trees, but the new ones were one year late in bearing. If the average yield of the orchard was $1\frac{3}{4}$ bushels to the tree for the first bearing year, how many apples did Mr. Henderson lose?

8. Mrs. Henderson made 3 gallons of apple jelly which she put into half-pint glasses. How many glasses did she use?

9. Mrs. Henderson cut into quarters 35 pounds of apples for drying. The dried apples weighed $\frac{3}{5}$ of their original weight. How much did they weigh?

10. The Henderson boys made $1\frac{1}{2}$ gallons of cider from $\frac{1}{2}$ bushel of apples. Later they made 2 bushels into cider and canned it in quart cans. How many cans did they use?

11. A fruit dealer bought 2 bushels of selected apples from the Henderson farm for which he paid $6.50. He sold the apples at 3 for 10 cents. What was his profit if there were 120 apples in each bushel?

12. The three Henderson children picked 20 gallons of ripe currants from the bushes between the apple trees. Their father gave them $1.80. The children divided the money equally. What was the share of the two boys?

60.* *Division by a Fraction:*

See previous lesson on p. 94.

1. *For study.*

a. $\frac{3}{4} \div \frac{2}{8} = ?$
$\frac{6}{8} \div \frac{2}{8} = 3$

b. $3\frac{1}{3} \div \frac{5}{6} = ?$
$\frac{10}{3} \div \frac{5}{6} = ?$
$\frac{20}{6} \div \frac{5}{6} = 4$

2. $2\frac{2}{3} \div \frac{8}{9}$
3. $4\frac{1}{5} \div \frac{3}{10}$
4. $3\frac{3}{4} \div \frac{5}{8}$
5. $1\frac{3}{6} \div \frac{9}{18}$
6. $3\frac{6}{8} \div \frac{3}{4}$
7. $4\frac{2}{3} \div \frac{2}{9}$
8. $6\frac{2}{3} \div \frac{5}{6}$
9. $10\frac{1}{2} \div \frac{7}{9}$
10. $4\frac{1}{2} \div \frac{3}{5}$
11. $3\frac{1}{4} \div \frac{2}{8}$
12. $4\frac{1}{2} \div \frac{3}{4}$
13. $1\frac{2}{3} \div \frac{5}{6}$
14. $3\frac{1}{5} \div \frac{8}{10}$
15. $4\frac{4}{10} \div \frac{2}{5}$
16. $6\frac{2}{3} \div \frac{4}{9}$
17. $9\frac{1}{3} \div \frac{4}{6}$
18. $7\frac{1}{2} \div \frac{5}{8}$
19. $8\frac{1}{4} \div \frac{3}{8}$

61. *Review Exercise.*

1. $4\frac{3}{4} + \frac{5}{8}$
2. $4\frac{3}{4} - \frac{5}{8}$
3. $3 \times \frac{3}{4}$
4. $\frac{10}{11} \div 5$ $\frac{10}{11} \div \frac{5}{1}$ $\frac{10}{11} \times \frac{1}{5}$
5. $\frac{10}{11} \div \frac{5}{11}$ $\frac{10}{11} \div \frac{5}{11}$ $\frac{10}{11} \times \frac{11}{5}$
6. $10 \div \frac{5}{11}$
7. $7\frac{2}{3} + \frac{5}{6}$ $\frac{10}{1} \div \frac{5}{11}$ $\frac{10}{1} \times \frac{11}{5}$
8. $7\frac{2}{3} - \frac{5}{6}$
9. $7 \times \frac{5}{6}$
10. $\frac{9}{10} \div 3$ $\frac{9}{10} \div \frac{3}{1}$ $\frac{9}{10} \times \frac{1}{3}$
11. $\frac{9}{10} \div \frac{3}{10}$ $\frac{9}{10} \div \frac{3}{10}$ $\frac{9}{10} \times$
12. $3 \div \frac{9}{10}$ $\frac{3}{1} \div \frac{9}{10}$ $\frac{3}{1} \times \frac{10}{9}$
13. $4\frac{1}{5} + \frac{2}{3}$
14. $4\frac{1}{5} - \frac{2}{3}$
15. $5 \times \frac{2}{3}$
16. $\frac{12}{13} \div 4$ $\frac{12}{13} \div \frac{4}{1}$ $\frac{12}{13} \times \frac{1}{4}$
17. $\frac{12}{13} \div \frac{4}{13}$ $\frac{12}{13} \times \frac{13}{4}$
18. $4 \div \frac{2}{3}$ $\frac{4}{1} \div \frac{2}{3}$ $\frac{4}{1} \times \frac{3}{2}$
19. $4\frac{4}{8} \div 1\frac{1}{2}$ $\frac{36}{8} \div \frac{3}{2}$ $\frac{36}{8} \times \frac{2}{3}$
20. $3 \times 1\frac{5}{8}$
21. $3\frac{5}{8} - 1\frac{1}{2}$
22. $\frac{6}{9} \div \frac{1}{3}$

62. *Written Dictation.*

1. Twelve ounces are what part of a pound? Lowest terms.

2. Two times $\frac{3}{10}$. Lowest terms.

3. At 60 cents a dozen, how much must I pay for 3 oranges?

4. Jack is 12 years old. His father is $3\frac{1}{4}$ times as old as he. How old is his father?

5. A man sold $\frac{1}{3}$ of his farm to one man and $\frac{1}{4}$ of it to another. What part had he left?

63. *Written Problems.*

1. Louis who is 17 years old was born in France. He has lived in this country 5 years and 3 months. How old was he when he came here? Solve with fractions.

2. A farmer sold $\frac{2}{3}$ of his flock of 528 sheep. How many had he left? Diagram.

3. A man exchanges $4\frac{1}{2}$ dozen eggs at 60 cents a dozen, for sugar at 10 cents a pound. How many pounds of sugar does he get? Two ways.

4. Bob tore a hole in the knee of his trousers for which his mother used a patch $1\frac{3}{4}$ inches square. How many inches did she sew around the edge?

5. Roscoe spends $\frac{1}{3}$ of his salary for board, $\frac{2}{9}$ of it for clothing and $\frac{1}{9}$ of it for other expenses. What part of his salary remains? Diagram.

6. A book page has a margin of $\frac{6}{8}$ of an inch all round. The print covers a space of $5\frac{5}{8}$ inches long and $3\frac{5}{8}$ inches wide. What is the width and length of the whole page? Drawing.

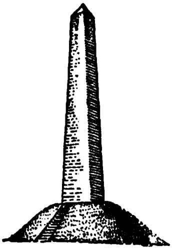
7. A cardboard box is 7 inches long, 4 inches wide and 3 inches high. Cut paper that would exactly line it. Make lining for sides and ends in one piece. How many square inches in the lining?

8. How many times are 7 days contained in 365 days? What is done with the fraction of a week?

9. In the first five chapters of a book are 188 pages. In the other three chapters are $\frac{3}{4}$ as many pages. How many pages in the entire book?

10. The area of the Philippines is one hundred fourteen thousand four hundred ten square miles; that of California one hundred fifty-eight thousand three hundred sixty square miles. What is the difference between their areas?

11. A pine tree 91 feet high has no branches for $\frac{3}{7}$ of its height. What is the height of the lowest branch?



12. A monument is $68\frac{3}{4}$ feet higher than the mound upon which it is built. The mound is 17 feet 6 inches high. What is the height of the top of the monument?

13. A grocer sold $\frac{3}{4}$ of a bushel of potatoes to one customer and 3 times that quantity to another. How much did he receive from each customer if the potatoes were sold at 15 cents a peck?

14. What will be the cost of a cement walk 150 feet long and 6 feet wide at $2.16 a square yard?

15. When a cheese that weighs 30 pounds is worth $12 how much is a twenty-pound cheese worth? One step.

16. A California vineyard of 32 acres yielded $5064 worth of grapes in one season. What was the value of the crop per acre?

17. The route from New York to San Francisco is thirteen thousand four hundred miles around the Cape, while through the Canal it is only seven thousand nine hundred miles. How much does the latter route shorten the distance?

18. How many pecks of beans does a man sell if each of 18 customers purchases 3 quarts?

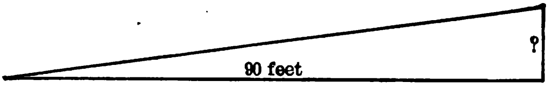
19. Four hams weighed respectively: $12\frac{1}{2}$ lb., $15\frac{3}{4}$ lb., $14\frac{1}{2}$ lb., and $16\frac{1}{4}$ lb. What was their combined weight?

20. If a man who owes me $23.75 gives me a ten-dollar bill, a five-dollar bill and a $$2\frac{1}{2}$ gold piece, how much does he still owe me?

21. When coal is $9 a ton, what will $15\frac{2}{3}$ tons cost?

22. At an average speed of 28 miles per hour, how long will it take a train to go from Chicago to Denver, a distance of 1028 miles?

23.



The approach to a viaduct rises 2 feet for every 15 feet horizontally. If the horizontal length is 90 feet, what is the height of the road at the viaduct?

24. If Mabel can cut out an apron in $\frac{5}{12}$ of an hour, how long will it take her to cut out a half dozen aprons?

25. How many strips of carpet $\frac{3}{4}$ yd. wide will be necessary to cover a floor 18 feet wide?

26. Helen is making candy from a recipe which calls for $1\frac{1}{2}$ cups of sugar. How many cupfuls will be required if the recipe is trebled?

27. Oscar made a pen for his rabbits. He inclosed a square $1\frac{2}{3}$ yd. on a side with wire netting. How many yards did he use?

28. Each of the children drinks $\frac{1}{2}$ pint of milk at school each day. On Monday they drank 9 quarts of milk. How many children were present?

29. A certain ship carries 320 barrels of flour weighing 196 pounds each, 25 tons of potatoes, 2 tons of sugar, $1\frac{3}{4}$ tons of coffee, $\frac{1}{2}$ ton of cheese. How many pounds of each article does the ship carry?

30. A stencil for a nursery wall is $1\frac{1}{2}$ feet long. How many times will it be repeated around the walls of a room which is 12 feet wide and 15 feet long?

31. Sam buys a pair of skates for $1.75. The next year he sells them at a loss of $\frac{3}{7}$ of the cost. For how much does he sell them?

64. *Find the product:*

1. $\begin{array}{r}985\\ \underline{67\frac{1}{5}}\end{array}$	**3.** $\begin{array}{r}768\\ \underline{89\frac{1}{6}}\end{array}$	**5.** $\begin{array}{r}593\\ \underline{58\frac{1}{9}}\end{array}$	**7.** $\begin{array}{r}879\\ \underline{67\frac{1}{3}}\end{array}$	**9.** $\begin{array}{r}968\\ \underline{87\frac{1}{4}}\end{array}$
2. $\begin{array}{r}896\\ \underline{58\frac{1}{7}}\end{array}$	**4.** $\begin{array}{r}858\\ \underline{47\frac{1}{6}}\end{array}$	**6.** $\begin{array}{r}975\\ \underline{49\frac{1}{5}}\end{array}$	**8.** $\begin{array}{r}750\\ \underline{45\frac{1}{10}}\end{array}$	**10.** $\begin{array}{r}875\\ \underline{43\frac{1}{5}}\end{array}$

65. *Decimal Fractions. — Introduction.*

1. *For demonstration.* Mr. Barnard bought an automobile which had traveled 3976 miles. On his first trip he drove 35.6 miles. How far had the machine then traveled?

It is desirable that this demonstration of the principle upon which a speedometer works should be given by some pupil in the class who already understands it. He should explain the figures "35.6."

2. Name three other inventions which measure or register by 10's.

3. Lay a square inch of paper upon your desk. Let it represent 1.

a. Lay paper to represent 11. To represent 2.
b. What is the difference between the two 1's in 11? In 2?

4. Represent 33 with two pieces of paper, one to represent each digit.

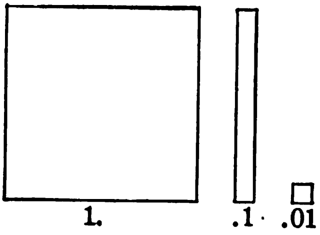
a b c
5. In the number 5 5 5:

a. The 5 under *c* is what part of the 5 under *b*?
b. The 5 under *b* is what part of the 5 under *a*?

6. Write the largest number possible with one figure. With 2 figures. With 4 figures.

7. *Complete and learn:* 10 ones = 1 ten.
10 tens = 1?
10 hundreds = ?

8. Cut out a square inch of paper. Cut it into ten equal strips.



Call one square inch of paper $1. Represent with paper: $1.10; $1.20; $1.70.

9. Take a piece of paper which represents a dime and cut it into tenths. Represent with paper $1.11; $1.12; $1.21. Continue.

10. One tenth of a cent is called a *mill*. There is no coin for mills. A mill is what part of a dime? Of a dollar?

11. *a.* *Read:* $2.754; $1.076; $.506.

b. *Write:* One dollar five mills; sixty cents eight mills.

Counting by tens is called the *Decimal System* — from a Latin word meaning "ten."

The dot placed between units and tenths of units is called the *decimal point.*

12. *Write:*

a. Without denominators: $\$1\frac{9}{10}$; $\$2\frac{3}{100}$; $\$5\frac{75}{100}$; $\$8\frac{6}{10}$.

b. With denominators: $2.07; $4.65; $3.17.

13. You have learned that a mile equals 320 rods, each containing $5\frac{1}{2}$ yards or $16\frac{1}{2}$ feet. Why does the speedometer divide the mile into tenths rather than into rods, yards and feet?

In continental Europe, in South America and elsewhere, land distances and many other things are measured by decimals in what is called the *metric system.*

66. *Find quotient:*

1. $5\frac{1}{4} \div \frac{3}{8}$ | $\frac{6}{8} \div 3$
2. $4\frac{1}{5} \div \frac{3}{10}$ | $\frac{6}{9} \div 2$
3. $6\frac{2}{5} \div \frac{4}{10}$ | $\frac{10}{11} \div 5$
4. $4\frac{4}{6} \div \frac{2}{3}$ | $\frac{14}{15} \div 7$
5. $7\frac{1}{2} \div \frac{3}{6}$ | $\frac{16}{19} \div 8$
6. $8\frac{1}{3} \div \frac{5}{6}$ | $\frac{12}{13} \div 3$
7. $4\frac{1}{2} \div \frac{3}{4}$ | $\frac{8}{9} \div 8$
8. $6\frac{2}{3} \div \frac{4}{9}$ | $\frac{15}{16} \div 5$

67. *Add and subtract at sight:*

1. $\begin{array}{r} 7\frac{3}{4} \\ \underline{5\frac{1}{2}} \end{array}$
2. $\begin{array}{r} 5\frac{5}{8} \\ \underline{4\frac{1}{4}} \end{array}$
3. $\begin{array}{r} 9\frac{1}{2} \\ \underline{3\frac{3}{8}} \end{array}$
4. $\begin{array}{r} 5\frac{5}{6} \\ \underline{4\frac{2}{3}} \end{array}$
5. $\begin{array}{r} 9\frac{4}{5} \\ \underline{7\frac{1}{10}} \end{array}$
6. $\begin{array}{r} 8\frac{3}{4} \\ \underline{2\frac{7}{8}} \end{array}$
7. $\begin{array}{r} 9\frac{7}{8} \\ \underline{3\frac{1}{4}} \end{array}$
8. $\begin{array}{r} 7\frac{8}{9} \\ \underline{2\frac{1}{3}} \end{array}$
9. $\begin{array}{r} 6\frac{2}{3} \\ \underline{1\frac{5}{6}} \end{array}$
10. $\begin{array}{r} 8\frac{7}{9} \\ \underline{6\frac{1}{3}} \end{array}$
11. $\begin{array}{r} 5\frac{5}{7} \\ \underline{2\frac{1}{14}} \end{array}$
12. $\begin{array}{r} 7\frac{2}{5} \\ \underline{2\frac{7}{10}} \end{array}$
13. $\begin{array}{r} 6\frac{2}{3} \\ \underline{2\frac{2}{9}} \end{array}$
14. $\begin{array}{r} 2\frac{3}{5} \\ \underline{2\frac{1}{10}} \end{array}$
15. $\begin{array}{r} 5\frac{1}{3} \\ \underline{2\frac{5}{9}} \end{array}$

68. *At sight:*

1. $3 \times 2\frac{1}{2}$
2. $5 \times 1\frac{5}{6}$
3. $2 \times 3\frac{2}{3}$
4. $6 \times 1\frac{7}{8}$
5. $4 \times 2\frac{4}{5}$
6. $6 \div \frac{2}{3}$
7. $5 \div \frac{3}{4}$
8. $4 \div \frac{7}{8}$
9. $9 \div \frac{4}{5}$
10. $3 \div \frac{5}{9}$
11. $\frac{3}{4} \div \frac{3}{8}$
12. $\frac{2}{3} \div \frac{2}{9}$
13. $\frac{4}{5} \div \frac{4}{10}$
14. $\frac{5}{6} \div \frac{5}{12}$
15. $\frac{3}{7} \div \frac{3}{14}$

69. *Add:*

1.	2.	3.	4.	5.	6.
375	759	956	896	945	896
866	996	879	767	967	999
284	968	464	667	538	568
747	383	845	335	965	897
694	499	798	788	999	685
739	181	483	992	369	389
289	467	979	899	787	677
886	746	199	748	388	485
999	989	987	898	899	734
898	979	657	687	789	797

70. *Oral Problems.*

1. A farm was so divided that $\frac{1}{5}$ of it was in pasture, $\frac{1}{3}$ of it in wheat and the rest in corn. What part of it was corn land?

2. The length of a certain rug is twice its width. It is $1\frac{5}{8}$ yards wide. What is its length?

3. A team traveled $4\frac{1}{2}$ miles in one hour and $3\frac{5}{8}$ the second hour. How far did it travel in the two hours?

4. The pendulum of a clock swings 4 times a minute. How many times does it swing in $\frac{1}{4}$ of an hour?

5. Three trunks at the Union Station stand side by side. The first is $2\frac{1}{3}$ feet wide; the second is $2\frac{2}{3}$ feet wide and the third is $2\frac{1}{3}$ feet wide. How wide is the space they occupy?

6. In Mr. Briggs's garden were 72 currant bushes. One sixth of the number was killed by scale. How many bushes lived? 72

7. A farmer bought an old sleigh for $19, and gave $7 to have it repaired and painted. He then sold it for $35. How much did he gain on his purchase?

8. A druggist buys tooth paste at 22 cents a tube and sells it at 27 cents. What is his profit on $1\frac{1}{2}$ dozen tubes?

9. Seven months are what part of a year? Five hours are what part of a day?

10. A milk dealer sells to his customers a ticket good for 6 gallons of milk. How long will it last a family that uses 3 pints each day? Fractions.

11. From a crate containing 2 bushels of tomatoes, 15 quarts were taken. What quantity remained?

12. A piece of linen $1\frac{1}{4}$ yards long was used to make a scarf for a dresser. On each end was sewed linen fringe $\frac{3}{8}$ of a yard wide. How long was the finished scarf?

13. A table top is 5 feet long and a yard wide. What is its area in square feet?

14. The pendulum of a clock swings twice each second. How many times does it swing in one minute?

15. If I walk 5 miles in $1\frac{1}{4}$ hours, in what fraction of an hour do I walk a mile?

16. The page of a book is 9 inches by $4\frac{1}{2}$ inches. What is its area?

17. Some wall paper is 18 inches wide. If $\frac{8}{9}$ of this is covered with a design, how wide is each of the white strips that run along the side?

18. I paid $12.50 for some silk at $2.50 a yard. How many yards did I buy? 12 2/3

19. What will 12 yards of tape cost at $6\frac{2}{3}$¢ a yard? 70

20. If a cooking recipe calls for 1 ounce of sugar to a person, how many pounds must be allowed in preparing the dish for 20 persons?

21. What change should you receive from a two-dollar bill after buying 2 loaves of bread for 20¢, one pound of butter for 60¢, one pound of coffee for 40¢? 70¢

22. A rug 3 yards 18 inches long is placed on a floor 7 yards long. How much of the length of the floor is not covered?

23. Three children are to do a piece of work. Two of them do $\frac{1}{4}$ and $\frac{1}{3}$ of the work. What part of the work is left for the third child?

24. If a strip of carpet is $\frac{3}{4}$ of a yard wide and 4 yards long, it is how many times as long as it is wide?

25. A room is 18 feet long and 12 feet wide. How many yards of matting 1 yard wide are required for the floor?

26. At 25¢ a box, how many boxes of raspberries can be bought for $3?

27. At 75¢ a yard, how much will 60 yards of thread lace cost?

28. If a train travels 2 miles in 3 minutes, how many miles will it travel in an hour?

71. *Decimal Fractions — Notation continued.*

See previous lessons, pp. 101, 102.

Ten-thousands.	*Thousands.*	HUNDREDS.	Tens.	ONES.	Tenths.	HUNDREDTHS.	*Thousandths.*	Ten-thousandths.
.	.	.	.	1.	.	.	.	.
.	.	.	1	0.	1	.	.	.
.	.	1	0	0.	0	1	.	.
.	1	0	0	0.	0	0	1	.
1	0	0	0	0.	0	0	0	1

1. *Read the following decimals:*

In reading a mixed number of which the fraction is a decimal, the word *and* is used between the integer and decimal, but nowhere else in the number; thus, 501.312 is read, "Five hundred one and three hundred twelve thousandths."

a. 11.18; 10.24; 81.6.
b. 50.07; 128.52; 40.93.
c. 7.08; 217.01; 3,000.02.
d. 32.416; 7.463; .275.
e. 11.092; .048; .002.

2. *Write the following as decimals:*

a. $\frac{7}{10}$ .7
$\frac{81}{100}$ .81
$\frac{121}{100}$ 1.21

b. $\frac{25}{100}$ .25
$\frac{3}{10}$ .3
$\frac{107}{1000}$ [illegible]

c. $\frac{45}{100}$ .45
$\frac{15}{10}$ 1.5
$\frac{24}{10}$ [illegible].4

d. $\frac{94}{100}$ .94
$\frac{561}{100}$ 5.6
$\frac{48}{10}$ 4.8

72. *Find quotient:*

1. $2\frac{5}{8} \div 7$
2. $8\frac{4}{7} \div 6$
3. $2\frac{2}{3} \div 4$
4. $5\frac{2}{6} \div 8$
5. $3\frac{4}{7} \div 5$
6. $7\frac{1}{5} \div 6$
7. $8\frac{3}{4} \div 7$
8. $6\frac{2}{9} \div 8$
9. $4\frac{2}{3} \div 7$
10. $5\frac{1}{3} \div 6$
11. $3\frac{3}{9} \div 15$
12. $5\frac{1}{4} \div 3$
13. $6\frac{1}{8} \div 7$
14. $7\frac{2}{9} \div 5$
15. $9\frac{3}{8} \div 3$

73. *Find quotient:*

1. 2,364,347 ÷ 179
2. 3,782,570 ÷ 138
3. 1,655,436 ÷ 394
4. 1,697,077 ÷ 283
5. 2,535,858 ÷ 382
6. 3,267,960 ÷ 359
7. 2,327,182 ÷ 398
8. 1,681,186 ÷ 185
9. 1 699 341 ÷ 157

74. *Multiply at sight:*

1. $\begin{array}{r}86\frac{3}{4}\\ \underline{4}\end{array}$	3. $\begin{array}{r}37\frac{1}{3}\\ \underline{9}\end{array}$	5. $\begin{array}{r}49\frac{2}{5}\\ \underline{5}\end{array}$	7. $\begin{array}{r}45\frac{1}{3}\\ \underline{9}\end{array}$	9. $\begin{array}{r}96\frac{1}{4}\\ \underline{8}\end{array}$
2. $\begin{array}{r}76\frac{1}{2}\\ \underline{6}\end{array}$	4. $\begin{array}{r}69\frac{1}{9}\\ \underline{9}\end{array}$	6. $\begin{array}{r}75\frac{1}{2}\\ \underline{4}\end{array}$	8. $\begin{array}{r}67\frac{3}{5}\\ \underline{5}\end{array}$	10. $\begin{array}{r}76\frac{1}{7}\\ \underline{7}\end{array}$

75. *Written Dictation.*

1. $40 - 26\frac{2}{3} = ?$

2. $\frac{3}{4} + \frac{2}{3} = ?$

3. How many packages of tea each containing $\frac{3}{8}$ of a pound can be made from $\frac{3}{4}$ of a pound of tea?

4. The railroad fare to Chicago is $\$4\frac{1}{2}$ and the parlor car seat is $\$\frac{3}{4}$. How much do they both cost?

5. A bank clerk has 35 dimes in one drawer. What is the value of the money in dollars?

76. *Find the quotient:*

1. $3\frac{3}{4} \div \frac{3}{8}$
2. $6\frac{2}{9} \div \frac{2}{3}$
3. $7\frac{1}{[illegible]} \div \frac{2}{7}$
4. $6\frac{6}{8} \div \frac{3}{4}$
5. $6\frac{6}{7} \div 3$
6. $9\frac{4}{9} \div 5$
7. $6\frac{8}{9} \div 2$
8. $8\frac{3}{4} \div 5$
9. $4\frac{2}{4} \div \frac{1}{3}$
10. $5\frac{5}{7} \div \frac{1}{2}$
11. $6\frac{6}{8} \div \frac{3}{4}$
12. $8\frac{4}{6} \div \frac{1}{3}$

77. *Find the product:*

1. $4 \times 1\frac{7}{8}$
   $3 \times 2\frac{5}{6}$
   $2 \times 4\frac{3}{8}$
   $5 \times 1\frac{6}{9}$

2. $7 \times 3\frac{3}{4}$
   $3 \times 3\frac{3}{9}$
   $4 \times 2\frac{3}{8}$
   $6 \times 1\frac{2}{5}$

3. $5 \times 1\frac{6}{7}$
   $3 \times 1\frac{4}{5}$
   $4 \times 4\frac{5}{7}$
   $6 \times 2\frac{8}{9}$

78. *The Cash Register in a Bakery.*

Clerk: Good morning! What will you have?

Customer: Good morning! How much are your cinnamon rolls?

Clerk: They are 12¢ a dozen.

Customer: I will take a dozen and a half. Have you raisin cake?

Clerk: Yes, indeed. Twenty cents a loaf.

Customer: I will take a loaf, please. How much is apple pie?

Clerk: Thirty cents.

Customer: I will take one.

Clerk (handing wrapped package): Sixty-eight cents, please.

Customer: Here is a dollar.

Clerk punches the proper amount on the register, puts the money into the drawer and takes out thirty-two cents in change.

Clerk: Sixty-eight, seventy, seventy-five, one dollar. Thank you.

Continue the dramatization until the class thoroughly understands not only the commercial method for making change but also the application of the decimal system underlying our currency.

Table of United States Money.

Complete and learn:

—— mills make 1 cent (¢).
—— cents make 1 dime.
—— dimes make 1 dollar ($).
—— dollars make 1 eagle.

79. *Suggestive Questions in Decimals.*

1. *Read orally:*

(1) .1
(2) .5
(3) .01
(4) .03
(5) 3.5
(6) .35
(7) 5.02
(8) 2.41
(9) 14.1
(10) 10.7
(11) 1.07
(12) 1.70

Continue.

2. *Write as integers, as decimal fractions or as mixed decimals:*

a

1 and 5 tenths.
15 hundredths.
15 thousandths.
150 thousandths.

b

896 thousandths.
89 and 6 tenths.
8 and 96 hundredths.
896.

c

7 and 3 tenths.
73 hundredths.
730 thousandths.
73 thousandths.

d

16 and 2 tenths.
162 thousandths.
1 and 62 hundredths.
16 thousandths.

e

56
5 and 6 tenths.
56 thousandths.
560 thousandths.

f

960
9 and 60 hundredths.
960 thousandths.
96 thousandths.

3. A man has one dollar and one dime. His dollar is how many times the value of his dime? Another man has a five-dollar bill and a five-cent piece. His bill is how many times the value of his nickel?

4. Write in words: 2014. How many figures do we need? Words?

5. How do we read 4018 when it is a telephone number?

6. At the post office, stamps are sold in square sheets containing 100. How many stamps in one row? A man who bought 25 stamps bought how many full rows?

7. Name a use of the decimal system made by the conductor on a street car.

8. What is an adding machine? Find out if you can the principle upon which it works.

9. How does the United States post office number all city blocks? On which side of the street and in which block would you expect to find 1567 Broad Street, Philadelphia?

80. *Written Problems.*

1. How many square feet in the ceiling of a room 12 feet wide, $14\frac{2}{3}$ feet long and $8\frac{1}{2}$ feet high?

16 ÷ 1/5

2. A boy selling papers earns at the average rate of $\$\frac{4}{5}$ a day. How many days did it take him to earn $16?

3. What is the dividend when the quotient is 320 and the divisor $\frac{3}{8}$? If you do not know how to solve this, help yourself by making another question just like this except that an integer is used for the divisor. 4550 ÷ 2

4. When $4550 buys 26 acres of ground, how much will 13 acres cost at the same price per acre? 26 ÷ 62 [redacted]

5. When apples sell at $\$6\frac{1}{2}$ a barrel, how many barrels can be bought for $26?

6. Required the cost of:

a. 8 gross pencils at $\$\frac{1}{4}$ per dozen.
b. 50 tons cotton at $17.50 a bale (500 lb. = 1 bale).

75 × 1/3

7. The diameter of a large driving wheel is 13 feet. The circumference of the wheel is $3\frac{1}{7}$ times the diameter. What is the length of the circumference?

8. A man drove $\frac{5}{12}$ of his journey on Monday and $\frac{1}{2}$ of it on Tuesday, and was still 6 miles from his destination. What was the length of the entire journey? How many miles did he drive on Monday?

9. Paid 35 cents a pound for 14 pounds of beef. If $\frac{2}{7}$ of it was bone and worth nothing, how much did ~~the~~ meat really cost per pound?

10. A man drew $1305 from the bank. He paid $\frac{2}{5}$ of it to one man on a debt, and $\frac{1}{3}$ of the remainder to a second man. How much money had he left?

11. What number must be added to $163\frac{4}{8}$ to make $796\frac{3}{4}$?

12. What is the multiplicand when the product is 7 and the multiplier is $4\frac{2}{3}$?

13. Dinner is to be served at 6 o'clock. At what time should a roast weighing $8\frac{3}{4}$ pounds be put into the oven, allowing 20 minutes to each pound for roasting?

14. What change will I receive from a ten-dollar bill after buying 7 yards of cloth at $\$1\frac{3}{8}$ a yard?

15. A steamer sailed $360\frac{5}{8}$ miles on Monday, $342\frac{2}{3}$ miles on Tuesday, $338\frac{5}{6}$ miles on Wednesday and was then $246\frac{7}{8}$ miles from its destination. What was the length of the entire journey?

16. A wet snow weighed 25 pounds to the square foot. What was the total weight sustained by a shed roof 12 feet wide and 18 feet long?

17. Herbert walked $2\frac{3}{4}$ miles in the morning and twice as far in the afternoon. How far did he walk during the entire day? One step.

18. A cold wave traveling at the rate of $34\frac{1}{2}$ miles an hour will travel how far in 24 hours?

19. A flag staff $60\frac{1}{4}$ feet high was broken off by a storm so that it measured $43\frac{5}{6}$ feet. How much was broken off?

20. A prize steer weighed 1600 pounds. It was sold at the rate of $16 a hundred pounds. What was the sale price?

21. How many yards of lace at $\$\frac{3}{4}$ a yard can be bought for $\$2\frac{1}{4}$? Solve by integers and by fractions.

22. Mr. Henry sold his automobile at $\frac{1}{4}$ less than the cost price. His loss was $227. What was his sale price? Diagram.

23. Mr. Brown burned $12\frac{1}{2}$ tons of coal last winter, 13.9 tons the winter before and $11\frac{2}{5}$ tons the winter before that. How much coal did he use in the three winters?

24. What is the cost of feeding a horse for one month if he eats $\frac{1}{16}$ of a ton of hay costing $36 a ton, and 10 bushels of oats at $74\frac{1}{2}$¢ a bushel?

81. *Multiply:*

1. $4 \times 3\frac{2}{5}$
$9 \times 2\frac{1}{4}$
$3 \times 5\frac{1}{2}$
$2 \times 6\frac{3}{4}$

2. $7 \times 3\frac{1}{3}$
$9 \times 1\frac{2}{7}$
$4 \times 3\frac{1}{2}$
$8 \times 2\frac{1}{5}$

3. $6 \times 2\frac{1}{6}$
$5 \times 4\frac{1}{2}$
$8 \times 3\frac{1}{3}$
$9 \times 1\frac{5}{6}$

4. $2 \times 8\frac{1}{3}$
$7 \times 4\frac{1}{3}$
$3 \times 9\frac{1}{2}$
$8 \times 2\frac{1}{3}$

82. *Read these decimals:*

1. .7
.07
.007

2. 80.8
8.08
.808

3. .076
7.06
70.6

4. 90.1
.901
9.01

83. *Express as decimal fractions or as mixed decimals:*

1. 7 tenths; 7 thousandths; 7 hundredths.

2. Eighty and fifty hundredths; six and seven hundred three thousandths; nine and eight thousandths.

3. Eighty-nine and eighty-nine thousandths; seven and sixty thousandths; fifty and four thousandths.

4. Four hundred and four hundredths; sixty and sixty hundredths; three and three thousandths.

84. *Add:*

1. $26\frac{3}{4} + 17\frac{5}{9} + 85\frac{2}{3} + 39\frac{5}{6} + 75\frac{7}{12}$.

2. $69\frac{5}{16} + 83\frac{7}{24} + 19\frac{9}{32} + 82\frac{5}{12} + 17\frac{7}{8}$.

3. $65\frac{5}{12} + 73\frac{11}{16} + 69\frac{7}{8} + 15\frac{5}{9} + 82\frac{7}{12}$.

4. $27\frac{6}{9} + 48\frac{8}{12} + 82\frac{5}{8} + 97\frac{3}{4} + 69\frac{2}{3}$.

5. $98\frac{1}{7} + 17\frac{4}{9} + 26\frac{1}{3} + 34\frac{6}{7} + 19\frac{1}{21}$.

85. *Table of Counting.*

20 things make 1 score.
12 things make 1 dozen.
12 dozens make 1 gross.
12 gross make 1 great gross.

86. *The Meyer Department Store — Written.*

1. In the store were 250 clerks. One fifth of these received on the average $27 a week and the rest on the average $18 a week. What was the weekly pay-roll of the firm?

2. The number of clerks during the holidays is $\frac{3}{2}$ of the number of regular clerks. How many new clerks were employed during the holidays?

3. For every 5 clerks there were on the average 100 customers each day during the holidays. How many customers were in the store in one day?

4. The main aisle in the store is 10 rods long. If the floor-walker covers $\frac{4}{5}$ of this distance 20 times during the day, how many feet does he walk?

5. A cash boy runs $\frac{3}{4}$ of a mile between 9 and 10 in the morning. This is half of the distance that he runs between 10 and 11. How far does he run during the two hours?

6. If a wrapper ties 42 packages between 9 and 10 in the morning and $\frac{8}{7}$ of that quantity the next hour, how many packages does she wrap in the 2 hours?

7. If the store is open from 8 A.M. until 5:30 P.M. every day except Saturday when it closes at 1 P.M., how many hours is it open during the week?

8. During 2 weeks of the holidays, the store kept open until 9 o'clock each evening. How many extra hours did the clerks work during the two weeks?

9. How much extra money was made by a girl who received $\$\frac{1}{4}$ an hour?

10. If a clerk is given $\frac{1}{20}$ of all her sales over $100 a week, how much extra will she receive when her sales are $140?

11. A girl was allowed 45 minutes for lunch. If she left at 12:20 P.M., at what time was she due to return?

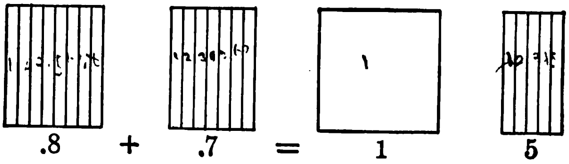
12. If there were 4500 adult customers in the store during the day and $\frac{1}{9}$ as many children, how many customers were there in all during the day?

87.* *Addition of Decimals.*

1. *For study.* Charles skated .8 of a mile in five minutes and .7 of a mile in the next 10 minutes. How far did he go in all?

Solution by Common Fractions	Solution by Decimals
$\frac{8}{10}$ mi.	.8 mi.
$\frac{7}{10}$ mi.	.7 mi.
$\frac{15}{10}$ mi. $= 1\frac{1}{2}$ mi.	1.5 mi.
Charles skated $1\frac{1}{2}$ miles.	Charles skated 1.5 miles.

Why are the numbers written so that the decimal points fall under each other?



2. A pan of navy beans which weighed 1.15 pounds absorbed 1.07 pounds of water. What was the weight of the beans after they were soaked?

3. Three men agreed to do a piece of work. In one day, A did .1 of it, B did .04 of it and C did .06 of it. What decimal part of the work did all these three do in one day?

Make sure that the pupils understand that the principle, "Only like numbers can be added or subtracted" applies to decimals. If possible, let them discover the application of that principle in the foregoing problem.

4. If a machine cut .5 of a field of grain in one day and .45 of it the second day, what part did it cut in the two days?

5. For 6 months one year the rainfall in a certain place was 2.3 inches, 4.49 inches, 1.6 inches, 5.03 inches, 2.7 inches, 4.09 inches. Find the total rainfall for those months.

88. *The Meyer Department Store — Oral.*

1. What amount was paid for each of the following purchases?

1. Two house dresses at $3.75 each.
2. One child's sweater at $1.18; knitted cap at 99¢.
3. One baby's cloak at $1.35; white hood at 79¢.
4. $\frac{1}{2}$ doz. bibs at 15¢; woolen sacque at $1.18.
5. One boy's rompers at $.60; pair of child's shoes at $1.15.
6. One baby's carriage at $7.50; robe at $3.75.
7. Three pairs of hose at 75¢ a pair.
8. Boy's heavy sweater coat $8.75; knitted polo cap $1.89.
9. One bath robe at $9.50; house slippers at $2.19.
10. One boy's Norfolk suit at $5.75; overcoat at $6.25.
11. One sailor blouse suit at $4; waterproof coat at $2.89.
12. One muff and scarf set $28.50; girl's ready trimmed hat $4.50.
13. $5\frac{1}{4}$ yards of ribbon at 24¢ a yard.
14. Five yards of blue serge at $2 a yard; $\frac{1}{2}$ doz. buttons at 90¢ per doz.
15. One pair of kid gloves at $2.25; box of cleaner 49¢.
16. Woman's winter coat at $28.50; alterations $1.75.
17. One dozen handkerchiefs at $12\frac{1}{2}$¢ each.
18. Child's ready-made dress $3.75; pair of cotton gloves at 50¢.
19. Ten yards of linoleum at $1.75 a yard.
20. One cream and sugar set at $1.65; teapot at $1.50.
21. Two papers of pins at $.15 each; 3 boxes of hairpins at $.25 each.

2. One customer at the lace counter made her purchase in 6 minutes. The customer following her took $\frac{5}{3}$ as much time. How much time did the second customer take?

3. The average sales at the umbrella counter for one day were $60. One rainy day the sales were $\frac{8}{5}$ of this amount. How much were their rainy day sales?

4. In the hair dressing department 20 women had their hair shampooed at $1 each and 5 children had their hair bobbed at 30¢ each. Find the total receipts for the day.

5. The millinery department averaged 16 customers a day in the dull season. On the day of the spring opening there were 3½ times that many customers. How many customers were there on that day?

6. The Meyer Department Store has 4 deliveries a day, two hours apart. The first delivery leaves the store promptly at 9:45 A.M. At what hours are the other deliveries made?

7. If it takes 15 minutes to load a delivery car, at what time must it return to the store to be reloaded for the second delivery?

8. If a delivery car makes 4 trips a day each 1¾ hours long, how many hours has it traveled during the day?

9. There were three of the delivery cars. Each driver received $40 a week and his helper received ⅕ of that amount. What were the wages of all six employees for a week?

10. If the repairs on one car for 3 months were $60 for the first month, for the second month $72, and for the third $56, what was the entire repair bill?

11. If two of the cars had cost $1500 each, and the third ⅗ as much as the other two together, what was the cost of the third car?

12. If on the first trip one morning, one of the cars delivered 90 parcels and on the second trip it delivered ⅓ more than on the first, how many did it deliver on both trips?

13. The total value of the goods delivered during the 12 days preceding Christmas was $28,800. What was the average value of each day's deliveries?

It will be found interesting to gather from the children a list of all of the varieties of business employing motor trucks. Many interesting problems can be made by the pupils.

107 43

89. *Find the sum. Find the difference.*

$$\begin{array}{lllll}
\cancel{1.\ 83}\begin{array}[t]{r}\frac{7}{9}\end{array} & 3.\ \begin{array}[t]{r}93\frac{5}{7}\\ \underline{56\frac{3}{5}}\end{array} & 5.\ \begin{array}[t]{r}81\frac{5}{6}\\ \underline{47\frac{3}{7}}\end{array} & 7.\ \begin{array}[t]{r}74\frac{8}{9}\\ \underline{67\frac{5}{6}}\end{array} & 9.\ \begin{array}[t]{r}90\frac{4}{5}\\ \underline{61\frac{3}{8}}\end{array}\\
\quad\underline{64\frac{5}{8}} & & & & \\[2ex]
2.\ \begin{array}[t]{r}54\frac{7}{9}\\ \underline{36\frac{3}{4}}\end{array} & 4.\ \begin{array}[t]{r}90\frac{11}{12}\\ \underline{16\,\frac{4}{5}}\end{array} & 6.\ \begin{array}[t]{r}75\frac{13}{15}\\ \underline{29\,\frac{2}{3}}\end{array} & 8.\ \begin{array}[t]{r}87\,\frac{3}{4}\\ \underline{49\frac{5}{12}}\end{array} & 10.\ \begin{array}[t]{r}52\,\frac{2}{3}\\ \underline{28\frac{13}{18}}\end{array}
\end{array}$$

90. *Find the product.*

$$\begin{array}{lllll}
1.\ \begin{array}[t]{r}498\\ \underline{89\frac{1}{6}}\end{array} & 3.\ \begin{array}[t]{r}585\\ \underline{47\frac{1}{5}}\end{array} & 5.\ \begin{array}[t]{r}856\\ \underline{87\frac{1}{4}}\end{array} & 7.\ \begin{array}[t]{r}693\\ \underline{96\frac{1}{7}}\end{array} & 9.\ \begin{array}[t]{r}789\\ \underline{59\frac{1}{3}}\end{array}\\[2ex]
2.\ \begin{array}[t]{r}687\frac{1}{3}\\ \underline{75}\end{array} & 4.\ \begin{array}[t]{r}764\frac{1}{5}\\ \underline{95}\end{array} & 6.\ \begin{array}[t]{r}842\frac{1}{4}\\ \underline{68}\end{array} & 8.\ \begin{array}[t]{r}527\frac{1}{6}\\ \underline{78}\end{array} & 10.\ \begin{array}[t]{r}659\frac{1}{7}\\ \underline{56}\end{array}
\end{array}$$

91. *Add:*

$$\begin{array}{llll}
1.\ \begin{array}[t]{r}367.07\\ 43.4\\ 540.609\\ 697.874\\ 96.085\\ 896.97\\ 79.608\\ 703.075\\ 69.8\\ \underline{897.008}\end{array} &
2.\ \begin{array}[t]{r}709.065\\ 84.6\\ 765.078\\ 69.960\\ 875.479\\ 607.704\\ 4.4\\ 40.040\\ 114.411\\ \underline{608.086}\end{array} &
3.\ \begin{array}[t]{r}298.048\\ 2.6899\\ 468.06\\ 18.408\\ 9.98\\ 998.4\\ 7.76\\ 176.539\\ 87.850\\ \underline{991.046}\end{array} &
4.\ \begin{array}[t]{r}40.698\\ 299.763\\ 17.096\\ 898.900\\ 67.48\\ 9.846\\ 108.678\\ 45.29\\ 2.187\\ \underline{999.877}\end{array}
\end{array}$$

92. *Divide at sight:*

1. $6\overline{)498\frac{12}{32}}$ 3. $5\overline{)570\frac{15}{16}}$ 5. $8\overline{)824\frac{8}{13}}$ 7. $3\overline{)918\,\frac{9}{16}}$

2. $6\overline{)486\frac{6}{7}}$ 4. $4\overline{)924\frac{12}{14}}$ 6. $2\overline{)902\frac{2}{3}}$ 8. $7\overline{)630\frac{14}{15}}$

93. *Find quotient:*

1. $4\frac{2}{3} \div 7$ 4. $5\frac{2}{6} \div \frac{2}{3}$ 7. $3\frac{3}{6} \div 7$

2. $6\frac{1}{4} \div 5$ 5. $3\frac{3}{4} \div \frac{3}{8}$ 8. $4\frac{4}{7} \div \frac{4}{14}$

3. $9\frac{1}{3} \div 4$ 6. $2\frac{4}{5} \div \frac{7}{10}$ 9. $6\frac{2}{3} \div 5$

94. *Written Problems.*

1. The product of two numbers is 564,750. One of the factors is 375, what is the other?

2. Of three trains entering the city, one has 216 passengers, the second 97 more than the first, and the third as many as the other two together. How many passengers in all?

3. A carpenter bought 680 feet of lumber at one time and $\frac{7}{8}$ as much at another time. How many feet did he buy in all?

4. If a 5-foot staff casts a shadow $\frac{3}{4}$ of a yard long, what is the length of the staff that casts a shadow $1\frac{1}{2}$ yards long? Drawing.

5. Mr. Knox put 12 tons of coal into his cellar in the fall. Of this $\frac{1}{4}$ was soft coal. By spring all of the soft coal was gone and only $\frac{1}{3}$ of the hard coal remained. How many tons of each had he used?

6. Make and solve problems based upon the following items:

$\$\frac{4}{5}$ to buy lace at 20¢ a yard.
$\$2\frac{2}{5}$ to buy apples at $\$\frac{6}{10}$ a peck.
$\$1\frac{7}{8}$ to buy butter at $\$\frac{5}{8}$ a pound.

7. If $1\frac{3}{8}$ bushels of wheat will sow one acre, how many bushels will be required to sow 40 acres?

8. A field is $10\frac{7}{8}$ rods long and $6\frac{1}{2}$ rods wide. How long will be the hedge of osage orange around it?

9. A man has a lawn 30 feet by 60 feet. How much will it cost him to have it sodded at 28¢ a square yard?

10. A vinegar cask is $\frac{7}{8}$ full after 4 gallons have been drawn out. How many gallons were in the cask at first?

11. A certain railroad employs 24 firemen for each 100 miles. If it has 10,000 miles of road, how many firemen are employed?

12. If the cost of a yard of cloth is $\$\frac{6}{8}$, how many yards can be bought for $\$1\frac{1}{2}$?

13. If 3 boxes of oranges can be bought for $12, how much will 15 like boxes cost?

14. How many panes of window glass 8 inches long and 6 inches wide can be cut from a piece 4 feet long and 12 feet wide?

15. Harold and Roy whitewashed a fence 150 yards long, beginning at the ends and working toward the middle. When Harold had whitewashed $38\frac{3}{4}$ yards and Roy had whitewashed $42\frac{5}{8}$ yards, how much remained to be done?

16. Find the sum of the product and the difference of 256 and 347.

17. A man paid $36 for a suit of clothes, $\frac{1}{12}$ as much for a pair of shoes, and $\frac{1}{9}$ as much for a hat. What was the cost of his entire outfit?

18. A boy came home for his vacation on December 23. He returned to college on January 5. What was the length of his vacation? Count both days named.

19. A wholesale grocer has stored in his cellar 12 barrels of vinegar each containing $31\frac{1}{2}$ gallons. How many gallons of vinegar are stored in the cellar?

20. A boy mows an acre of grass in 2 hours. In how many hours can he mow $\frac{4}{5}$ acres? How many acres can he mow in 4 hours?

21. If one bushel of potatoes cost \$$1\frac{1}{4}$, how much will 5 bushels cost?

22. At \$$\frac{3}{4}$ each, how many cakes can be bought for $6?

23. If 40 yards of goods cost $25, how much will 8 yards cost?

24. A man paid $4400 for his lot and $2\frac{1}{2}$ times that sum for his house. What was the value of his whole property?

25. Mrs. Howe bought $4\frac{1}{2}$ pounds of sugar and used 12 ounces of it. How many ounces did she have left? Solve with fractions.

26. If 150 desks which cost $12 each are sold at $\frac{1}{3}$ more than they cost, how much is the entire gain? Two ways.

27. How much picture molding will be needed for a room $18\frac{3}{4}$ feet long and $14\frac{1}{2}$ feet wide?

95. *Suggestive Questions in Decimals.*

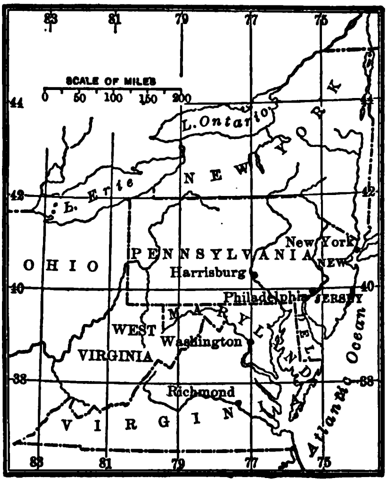
See previous lesson, p. 109.

1. A bookkeeper in calculating a debt wrote the amount as $3.42. The correct amount was $34.20. How much would his employer have lost had the mistake not been discovered?

2. Prove by moving the decimal point right and left how important it is to have it placed exactly where one intends. Use $563478 and without changing the order of the figures make it into as many different sums of money as you can.

3. Ask pupils to draw upon the board a gas, an electric and a water meter. Give instruction in reading the dials.

4. What is the name of the first place to the left of the decimal point? Of the first place to the right? Of the third place to the right?



5. Using the scale of miles find the distance between:

a. New York and Philadelphia.

b. Philadelphia and Washington.

c. Washington and Richmond.

d. Washington and Harrisburg.

6. Why could you not use the information you received in question 5 as a basis for calculating your railroad fare between those cities?

7. In what degree of latitude do you live? Of ongitude?

96. *Subtract at sight:*

1. $\begin{array}{r}30\frac{1}{3}\\ \underline{15\frac{1}{4}}\end{array}$
2. $\begin{array}{r}20\,\frac{2}{5}\\ \underline{5\frac{1}{10}}\end{array}$
3. $\begin{array}{r}10\,\frac{1}{5}\\ \underline{3\frac{1}{10}}\end{array}$
4. $\begin{array}{r}10\frac{1}{3}\\ \underline{9\frac{7}{9}}\end{array}$
5. $\begin{array}{r}30\frac{1}{2}\\ \underline{20\frac{1}{3}}\end{array}$
6. $\begin{array}{r}30\,\frac{4}{5}\\ \underline{1\frac{7}{10}}\end{array}$
7. $\begin{array}{r}40\frac{2}{3}\\ \underline{30\frac{1}{6}}\end{array}$
8. $\begin{array}{r}40\frac{5}{6}\\ \underline{39\frac{2}{3}}\end{array}$

97. *Find quotient:*

1. $1{,}174{,}144 \div 175$
2. $1{,}247{,}363 \div 156$
3. $1{,}558{,}490 \div 193$
4. $1{,}338{,}280 \div 168$
5. $1{,}452{,}900 \div 185$
6. $1{,}497{,}646 \div 165$

98. *Find the sum:*

1. One thousand one and one thousandth; three hundred and three hundred thousandths; thirty and thirty thousandths.

2. Fifty-six and fifty-six thousandths; one hundred nine and nine hundredths; eight thousand and eight thousandths.

3. Four and four thousandths; seven hundred one and one hundred seven thousandths; six hundred eighty and six hundred eighty thousandths.

4. Nine hundred sixty-seven and seventy-six thousandths; five and fifty thousandths; eight and eighty thousandths.

99. *Find the quotient:*

1. $4\frac{1}{5} \div 3$
$3\frac{1}{8} \div 5$
$6\frac{6}{7} \div 8$
$9\frac{1}{3} \div 7$

2. $8\frac{2}{3} \div 2$
$4\frac{2}{7} \div 5$
$6\frac{3}{4} \div 9$
$6\frac{2}{3} \div 4$

3. $7\frac{3}{4} \div 6$
$5\frac{1}{7} \div 9$
$6\frac{3}{5} \div 3$
$8\frac{2}{9} \div 2$

4. $8\frac{2}{5} \div 7$
$7\frac{3}{6} \div 9$
$9\frac{4}{9} \div 5$
$5\frac{3}{9} \div 3$

100. *Complete and learn:*

a. $3 \times 14 = 42$
$4 \times 14 = 56$
to
$7 \times 14 = 98$

b. $98 \div 14 = 7$
$84 \div 14 = 6$
to
$42 \div 14 = 3$

c. $98 \div 7 = 14$
$84 \div 6 = 14$
to
$42 \div 3 = 14$

101. *Oral Problems.*

1. A picture is $3\frac{1}{4}$ inches wide and the mat is $1\frac{1}{8}$ inches wide on each side. How wide are the picture and the mat together?

2. A board $5\frac{3}{4}$ inches wide is planed down $\frac{3}{8}$ of an inch. How wide is it then?

3. A grocer paid $5.76 for a dozen bottles of olives and $21.60 for a gross of canned corn. What was the amount of his bill?

4. The perimeter of a triangle is 45 inches, and two of the sides are 15 inches and 16 inches. What is the length of the other side?

5. If we divide 378 sq. rd. of land into 9 equal building lots, what is the area of each?

6. At 50¢ a yard, what will $8\frac{1}{2}$ yards of madras cost?

7. A merchant bought 160 yards of cloth and sold $\frac{3}{4}$ of it. How many yards had he left?

8. If a train goes 1 mile in 90 seconds, how many minutes will it take to go 7 miles?

9. A farmer has a 15-acre meadow from which he cut last year $2\frac{3}{5}$ tons of hay to the acre. How many tons of hay did he cut?

10. Mr. Anderson has a piece of pasture land 30 rods long and 24 rods wide. How many square rods are there in this pasture?

11. If the side of a square is $2\frac{1}{3}$ inches, what is the perimeter?

12. On his last birthday William weighed $75\frac{3}{4}$ pounds. He has since gained $6\frac{1}{2}$ pounds. How much does he now weigh?

13. If a book is $\frac{3}{4}$ of an inch thick, how many such books are there in a pile 6 inches high?

14. A real estate dealer has $1\frac{1}{4}$ acres of land divided into lots of $\frac{1}{8}$ of an acre each. How many lots has he?

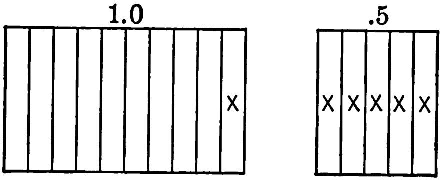
15. Make an original problem about a Boy Scout which the class can solve without pencil.

102.* *Subtraction of Decimals.*

1. *For study.* A dealer sold .6 of a ton of coal from a pile weighing 1.5 tons. What was the weight of the coal that remained?

Think	Write
1.5 = 15 tenths T.	1.5 T.
.6 = 6 tenths T.	.6
9 tenths T.	.9 T.

The coal that remained weighed .9 of a ton.



Austrian Method.
6 tenths + 9 tenths = 15 tenths.

2. From a piece of cloth containing 15 yards a clerk cut a piece 8.75 yards in length. How much remained?

If possible, have pupils discover for themselves why 15 must be changed to hundredths.

3. A woman kept two cows. The yield of one cow for a week was 140.3 lb. of milk and for the other 120.8 lb. Which cow gave the more milk and how much?

4. In 5 pounds of roasted peanuts 3.37 pounds are food and the rest is waste. How much waste is there in 5 pounds of peanuts?

5. A quart of milk weighs 2.155 pounds, and a quart of water 2.089 pounds. Which is the heavier and how much?

6. Louis rode 15.2 miles on his bicycle in the morning and 11.9 miles in the afternoon. How much farther did he go in the morning than in the afternoon?

7. A farmer sold .15 of his farm to a neighbor. What part did he keep?

103. *Written Problems.*

1. Estimating that one gallon of paint is required to give 400 sq. ft. of surface one coat, how many gallons of paint are required to give two coats of paint to both sides of a tight board fence 160 feet long and 5 feet high?

2. Traveling at the rate of 48 miles an hour, how far will a train go between 8:15 A.M. and 11:30 A.M.?

3. An automobile travels 29.7 miles the first hour and 23.9 miles the second hour. How far does it travel in the two hours?

4. How many bushels of apples at $\$2\frac{3}{4}$ a bushel can be bought for $22?

5. A man has three adjacent lots with a frontage of 152.5 feet. One of the lots has a frontage of 54.75 feet and another of 47.5 feet. What is the frontage of the third lot?

6. A clerk has a salary of $125 a month, and his expenses are $72 a month. How long will it take him to save $720?

7. I paid $90 an acre for 60 acres of woodland. I sold the wood for $3600 and the land for $40 an acre. Did I gain or lose and how much?

8. What change should be received from $60, in payment for 18 dozen buttons at 35¢ a dozen, 9 yards of velvet at $4.25 a yard, and 16 yards of lining at 27¢ a yard?

9. How many yards of ribbon will it take to run in the tops of 38 bags, if it takes 28 inches for one bag? How much will the ribbon cost at $.15 a yard?

10. If a boy spends 45 minutes each day in reading, how many hours does he read in a year?

11. A farmer has 6 fields containing $25\frac{3}{4}$ acres, $32\frac{2}{3}$ acres, $17\frac{7}{8}$ acres, $35\frac{1}{2}$ acres, $40\frac{7}{16}$ acres and $42\frac{1}{6}$ acres. How many acres has he in all?

12. The playhouse windows were 42 inches high. How much dotted Swiss did Elizabeth buy to make 2 curtains for each of 4 windows, if she allowed $3\frac{1}{4}$ inches on the length for hems?

13. Make an original problem about Elizabeth and her playhouse which the class can solve without pencil.

14. A has 54.05 tons of hay; B has 2.075 tons less than A. How many tons of hay have A and B?

15. If each pupil should have 15 sq. ft. of floor space, how many square yards of floor should there be in a room to accommodate 35 pupils?

16. A steamship carried on one trip 524 first cabin passengers and $\frac{3}{4}$ as many steerage passengers. How many steerage passengers were there?

17. In order to catch a train a man drove 16.75 miles in two hours. If he drove 9.375 miles the first hour, how many miles did he drive the second hour?

18. In building a factory, 317 loads of bricks averaging 943 bricks each were used. How many bricks were used?

19. How many seconds are there in a day?

20. Find a grocer's gain on 200 pounds of sugar bought at $19\frac{3}{8}$¢ a pound and retailed at $20\frac{1}{4}$¢ a pound.

21. If an acre of clover yields 1.5 tons of hay, how many pounds does it yield?

22. Find the cost of cementing the floor of a cellar 36 feet long and 18 feet wide at $2.16 per square yard.

23. If 10 eggs weigh one pound, how much would 10 dozen eggs weigh?

24. If a man's income is $1800 for a year and his expenses are $1275, what are his average savings per month?

25. Express each of the following as a decimal part of a dollar and find their sum: 37.5 cents; 1.25 cents: 4.5 mills; and $\$\frac{3}{4}$.

26. What number added to 3.2 will produce 19.46?

27. Write $6\frac{3}{4}$ millions in figures.

28. A dealer paid $600 for a ton of cheese and retailed it at 50¢ per pound. Find his profit.

29. Thirty-two degrees Fahrenheit is the freezing point. When the thermometer registers 4 degrees below zero, how many degrees is it registering below freezing?

30. What is the cost of a load of hay weighing 2500 pounds at $36 a ton?

31. Find the value of 28 pounds 12 ounces of beef at 38¢ per pound.

32. On an acre of land a farmer used $48\frac{3}{4}$ bushels of lime, weighing 80 pounds per bushel. How many pounds of lime did he use?

33. A machine can set 45 screws per minute. At the same rate, how many screws can it set in a day of 8 hours?

34. A cargo of lemons consisted of 34,000 boxes, each weighing 86 pounds. Find the weight of the cargo.

35. America was discovered by Columbus in the year MCDXCII. How many years have passed since that event?

36. After a man has traveled 561 miles on a 1000-mile mileage book, how much mileage has he left?

37. A piece of timber when wet weighed 875.25 pounds. After it was seasoned, it weighed only 560.5 pounds. How many pounds was the weight reduced by seasoning?

38. A 50-acre vineyard in California produced grapes worth $7700. Find the value of the crop per acre.

39. Find the cost of 2 hams at 35¢ a pound, one weighing 12 pounds 8 ounces and the other 14 pounds 4 ounces.

40. Write according to the Roman system the smallest number possible with I, V, X and L. Write the largest number possible.

Test Page I

This page and the one following contain types of exercises which the class should do readily before proceeding to more difficult work. A class percentage of not less than eighty should be required.

These pages can also be used for classes about to take up the work of the first section, Part II.

I

Write answers only:

1. Write in figures: One thousand and one thousandth; in Roman numerals: 1776.

2. Write in words: 4084.084.

3. There were 31 acres planted in corn on my uncle's farm. This was 17 acres more than were in the orchard. How many acres in the orchard?

4. How much will I spend for 3 rubber balls at $\$\frac{3}{4}$ each?

5. Howard practiced $3\frac{3}{4}$ hours during the week on his violin. If he practiced $\frac{1}{3}$ of the time on Monday, how long did he practice on that day?

II

Show all work — time limit 25 minutes:

1. In the first five chapters of a book are 184 pages. In the other three chapters are $\frac{3}{4}$ as many pages. How many pages in the entire book? Diagram.

2. A rectangular piece of ground is 8 rods wide and 10 rods long. What part of an acre does it contain?

3. How long a fence would be required for a rectangular field which is 16.8 rods long and 10.5 rods wide?

4. Mrs. Layman roasted a turkey 2 hours and 45 minutes. It was served at 1 P.M. At what time had she put it into the oven?

5. If it takes $\frac{5}{8}$ of a yard of lace to edge a pair of cuffs, 5 yards of lace will edge how many pairs of cuffs of the same size?

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Test Page II

III

Oral Problems.

Before solving, name the operation to be used in the problem.

1. What must be paid for $2\frac{1}{3}$ weeks' board at $9 a week?

2. If 5 men do a piece of work in 15 days, how long will it take one man to do the work?

3. A candy dealer used $\frac{2}{3}$ of a yard of cord to tie one box of candy. How many such cords could he cut from a bolt containing 6 yards?

4. A chemical company bought 40 boxes containing gummed labels to use on bottles. In each box were 100 labels. How many labels in all the boxes?

5. If flour weighs $\frac{4}{5}$ as much as the wheat from which it is made, how many pounds of flour can be made from 15 pounds of wheat?

IV

Write at dictation:

1. Add: 9.86 + 78.9 + .509 + 83.47 + 748.7 + 3.218 + 27.875. (two minutes)

2. Find the difference between $506\frac{3}{5}$ and $378\frac{5}{6}$. (two minutes)

3. Multiply $4\frac{2}{3}$ by 5. (one minute)

4. Divide $5\frac{1}{3}$ by 4. (one minute)

5. Divide 1,603,282 by 198. (three minutes)

V

Each child one exercise: (oral)

1. $1\frac{1}{2} - \frac{1}{2} = ?$
$5 \times 2\frac{3}{7} = ?$
$\frac{6}{7}$ of $91 = ?$
$5 \div \frac{4}{7} = ?$
$2\frac{1}{5} \div \frac{9}{10} = ?$

2. $2\frac{3}{4} + \frac{7}{8} = ?$
$2\frac{2}{5} \div 6 = ?$
$6 \times 7\frac{3}{4} = ?$
$\frac{2}{9}$ of $126 = ?$
$2\frac{1}{6} - \frac{2}{3} = ?$

3. $\frac{5}{6}$ of $90 = ?$
$3 \times 4\frac{1}{2} = ?$
$3 \div \frac{5}{6} = ?$
$1\frac{1}{5} - \frac{1}{4} = ?$
$4\frac{5}{6} \div \frac{2}{3} = ?$

PART II — SECTION ONE

1. *Buying a Motor Truck — Oral.*

1. A wholesale grocer who owns 3 teams worth $500 each is considering whether he will buy a fourth team, or a motor truck which will do the work of 4 teams for $1850. Not considering upkeep, which is the cheaper investment? How much?

2. However, the truck will last only 4 years while the teams will probably last 8 years. If he keeps the teams, how much money will he save?

3. On the other hand, the upkeep of each team is $725 a year and the truck $2865. How much less is the upkeep of the truck than that of the 4 teams?

4. If the truck can travel 4 miles on one gallon of gasoline how far can it travel on 27 gallons?

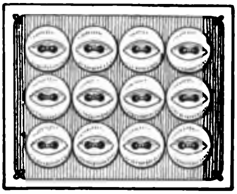
5. Each teamster receives $21 a week wages. What would be the wages of the driver of the truck, if he receives $\frac{5}{12}$ of the combined wages of the 4 teamsters?

6.† If, in spite of their slow teams, the teamsters could handle $\frac{1}{4}$ more goods than the driver of the auto, how much would be saved by giving him a helper at $15 which would increase his work $\frac{1}{4}$?

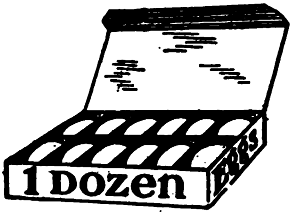
† See Table of Contents.

2.* *Factoring — Introduction.*

1. Name some things that are sold by the dozen. Tell how they are arranged for sale either for convenience or for attractiveness.



3 × 4 = 12



2 × 6 = 12

> Numbers, which multiplied together give another number, are called the *factors* of that number. A factor is an exact divisor of a number. 2 and 3 are factors or divisors of 6. Six is the *multiple* of 2 and 3.

2. The factors of: 8 are 2 and ——.
9 are 3 and ——.
15 are 3 and ——.

3. Give the factors of 14; of 21; of 28; of 35.

4. If 3 is one of the factors of 18, what is the other? If 2 is one of the factors, what is the other?

5. What are the multiples of the following factors: 6 and 7; 4 and 15; 3 and 18; 9 and 20?

6. Draw three rectangles, each having an area of 24 but having different dimensions. Factor 24 in three ways.

3. *Subtract:*

1.	$6\frac{2}{5}$	**3.**	$8\frac{1}{3}$	**5.**	$6\frac{1}{4}$	**7.**	$6\frac{3}{8}$	**9.**	$7\frac{5}{9}$
	$4\frac{3}{4}$		$5\frac{3}{4}$		$4\frac{2}{3}$		$4\frac{3}{7}$		$2\frac{3}{4}$

Teacher will please read the Preface and the Table of Contents. Lessons marked * should be assigned for study previous to the recitation. See Suggestions to Teachers.

4. *Written Dictation.*

1. Write in Roman numerals: 1620.

2. Write in figures: Ten and ten thousandths.

3. What number is $\frac{5}{4}$ of 20?

4. If 16 men earn $48 in one day, how much will 32 men earn at the same rate?

5. I had 60¢. I spent $\frac{3}{5}$ of it for a piece of beef shoulder. How much had I left?

5. *Multiply:*

1.	**2.**	**3.**
$6\frac{7}{8}$ by 7	$42\frac{3}{4}$ by 2	$94\frac{3}{5}$ by 5
$24\frac{1}{3}$ by 6	$51\frac{4}{5}$ by 5	$36\frac{1}{2}$ by 7
$5\frac{5}{6}$ by 5	$56\frac{2}{3}$ by 6	$35\frac{1}{8}$ by 8
$16\frac{3}{8}$ by 4	$68\frac{1}{6}$ by 8	$84\frac{7}{8}$ by 8

6. *Find the sum:*

1. Seventy-five hundredths; three and seven thousandths; sixty and sixty thousandths; four hundred and four hundredths.

2. Seventy-five and seven thousandths; seven and seventy-five thousandths; eighteen and eighty thousandths; eighty and eighteen thousandths.

7. *Find the sum:*

1.	**2.**	**3.**	**4.**	**5.**	**6.**
889	889	698	635	989	398
954	655	946	598	867	657
678	499	973	837	754	599
838	818	449	989	949	488
986	768	787	765	688	997
878	359	395	856	367	226
669	968	987	387	776	898
879	359	468	939	858	979
987	768	979	498	467	758
196	979	287	667	848	566

8. *Written Problems.*

1. How many 4-ounce packages can be put up from 9 pounds of pepper? At 10¢ a package, what will the pepper be worth?

2. A man sold $\frac{7}{8}$ of his hogs and had 60 hogs left. How many hogs did he sell?

3. A farmer brought butter and eggs valued at $4 to the grocery. He took in exchange 5 pounds of sugar at $9\frac{4}{5}$¢ per lb., 3 pounds of tea at \$$\frac{3}{5}$ per lb., and 3 pounds of coffee at \$$\frac{1}{3}$ per lb. How much does the grocer still owe the farmer?

4. Add seven hundred eighty and six thousandths; nine hundred nine and nine tenths; five and eight hundredths; sixty and eighty-seven thousandths; one thousand fifty and fourteen ten-thousandths.

5. An automobile started at 10:30 A.M. At 3:30 P.M. it had gone $78\frac{3}{4}$ miles. What was the rate per hour?

6. I pay for a purchase with a $5 bill and receive in change one of each of the coins commonly used. What was the amount of my purchase?

7. A man bought chestnuts at $1.20 a bushel and sold them at 5¢ a pint. What is his gain on $\frac{1}{4}$ of a bushel?

8. It takes $3\frac{1}{3}$ hours to motor to Brookville and $1\frac{3}{4}$ hours to go by train. How much time is saved in going by train?

9. If $\frac{1}{5}$ bushel of wheat will sow an acre, how many bushels will it take to sow $23\frac{1}{5}$ acres?

10. A piece of cloth contained 56 yards. After selling $\frac{5}{7}$ of it at one time and $4\frac{1}{2}$ yards at another time, how many yards were left?

11. A boy reads 24 pages of a book in an hour. At that rate how many pages can be read in $3\frac{5}{12}$ hours?

12. How many feet of wire are required to make 5 dozen nails if each nail requires $1\frac{7}{8}$ inches of wire?

By daily practice habituate the pupils in estimating results and in checking them.

13. From a cask of vinegar containing 63 gallons the following quantities were drawn: $6\frac{3}{4}$ gal.; $2\frac{1}{2}$ gal.; $15\frac{1}{4}$ gal.; $3\frac{3}{4}$ gal.; $12\frac{1}{2}$ gal. How much vinegar remained in the cask?

14. In a school there are 450 pupils. Of this number $\frac{5}{9}$ are girls. How many boys are in the school?

15. When tea is $\$\frac{3}{5}$ per pound, how many pounds can be bought for $\$4\frac{1}{5}$? Solve by U. S. money.

16. In a bill amounting to $60.50 the decimal point was written one place to the left of where it should have been. What was the difference in value between the footing as made and the correct amount?

17. A man having 480 books in his library gave away $\frac{1}{6}$ of the books, lent $\frac{1}{5}$ of them, and sold $\frac{1}{4}$ of them. How many books had he remaining?

18. A man deposited $\frac{1}{6}$ of his money in one bank, $\frac{5}{12}$ of it in another, loaned $\frac{1}{3}$ of it, and put the remainder into his safe. What part remained? Illustrate by drawing.

19. In one season a farmer sold 12,960 boxes of cherries, averaging 1 quart each, at $12\frac{1}{2}$¢ per quart. How much did he make?

20. When $\frac{3}{4}$ of a bushel of seed is used to plant an acre, how many acres can be planted with 120 bushels of seed?

21. In the month of October I spent $\frac{1}{4}$ of my money for coal, $\frac{1}{5}$ for rent, $\frac{1}{2}$ for groceries and had $36 left. How much had I at first?

22. Write in figures, one million one hundred one thousand one. Move the decimal point three places to the left; write the number in words as it now stands. Tell what change in the value of the number you made by moving the decimal point.

23. William, who is learning his trade, earns 18¢ an hour. How much does he earn in $1\frac{1}{2}$ days of 8 hours each?

24. In building the side walls of a house a man used 3200 bricks. In the end walls he used $\frac{5}{8}$ as many. How many bricks in all the walls?

9.* *Factoring — continued.*

See previous lesson, p. 130.

A number which can be factored only by itself and 1 is said to be a *prime* number. All other numbers are *composite*. 2 is *prime*. 4 is *composite*.

1. What is the meaning of the word *prime?* Of *composite?*

2. Complete for all numbers under 10:

Prime.	Composite.
$1 = 1 \times 1$	$4 = 2 \times 2$
$2 = 1 \times 2$	$6 = 2 \times 3$

3. The prime factors or divisors of 12 are: $2 \times 2 \times 3$. They can be obtained in this way:

$$\begin{array}{r@{)}l} 2 & \underline{12} \\ 2 & \underline{\ 6} \\ 3 & \underline{\ 3} \\ & \ \ 1 \end{array}$$

In the same way find the prime factors or divisors of 18. Of 24. Of 36.

4. Name the prime factors of all composite numbers between 21 and 30. Between 31 and 40. Write these in a table as under 2.

Continue this exercise until the pupils can readily recognize as prime or composite all numbers under 100.

5. Write all the numbers under 50 that can be exactly divided by 2. Are they odd or even numbers?

6. Write all the numbers under 100 that can be divided exactly by 5. How do these numbers end?

All —— numbers are divisible by 2. All numbers that end in —— or —— are divisible by 5.

10. *At sight.*

1. $9 \times \frac{4}{7}$
2. $8 \times \frac{5}{9}$
3. $7 \times \frac{3}{4}$
4. $5 \times \frac{2}{3}$
5. $6 \times \frac{5}{8}$
6. $7 \times \frac{5}{6}$
7. $5 \times \frac{7}{8}$
8. $6 \times \frac{7}{9}$
9. $9 \times \frac{4}{5}$
10. $4 \times \frac{3}{7}$
11. $8 \times \frac{5}{11}$
12. $5 \times \frac{4}{9}$
13. $10 \times \frac{5}{6}$
14. $7 \times \frac{3}{8}$
15. $8 \times \frac{3}{5}$

11. *Find quotient:*

1. 929,090 ÷ 183
2. 957,819 ÷ 139
3. 2,178,668 ÷ 278
4. 1,077,545 ÷ 156
5. 1,526,539 ÷ 189
6. 1,214,545 ÷ 176
7. 1,352,464 ÷ 149
8. 1,718,674 ÷ 286

12. *Find the difference between:*

1. Four million four hundred forty and four hundred forty ten-thousandths; and eight hundred thousand eight hundred and eight thousand eight ten-thousandths.

2. Sixty thousand and sixty thousandths; and seven thousand seven and seven thousandths.

3. Six hundred fifty thousand six hundred fifty and six hundred fifty thousandths; and seventy-five thousand and seventy-five thousandths.

4. Nine million nine hundred sixty thousand ninety-six and ninety-six ten-thousandths; and three million three thousand three and three thousandths.

13. *Find quotient:*

1. $2\frac{2}{5} \div 3$
$6\frac{1}{4} \div 5$
$7\frac{1}{3} \div 2$
$6\frac{2}{9} \div 8$
$5\frac{1}{3} \div 4$

2. $3\frac{3}{4} \div 5$
$4\frac{2}{7} \div 6$
$6\frac{2}{5} \div 4$
$7\frac{3}{6} \div 9$
$6\frac{3}{10} \div 7$

3. $7\frac{5}{7} \div 6$
$3\frac{4}{8} \div 7$
$4\frac{3}{6} \div 9$
$6\frac{6}{8} \div 9$
$4\frac{4}{11} \div 6$

4. $3\frac{3}{6} \div 7$
$4\frac{4}{7} \div 8$
$5\frac{5}{6} \div 7$
$9\frac{2}{6} \div 7$
$5\frac{3}{5} \div 4$

14.* *Denominate Numbers — Reduction Descending.*

It has been found convenient to have a name for those quantities which are measured by a unit fixed by law or custom, as the bushel is the unit for measuring many farm products, the pound for things sold by weight, etc. Such quantities (or concrete numbers) are called *denominate numbers.* 5 feet is a *simple denominate number;* 5 feet 7 inches is a *compound denominate number.*

Many interesting stories are told about the origin of denominate numbers. In olden times the hour glass filled with sand was used to mark the hour. Notched candles indicating the hours were used for the same purpose. It is said that linear measure was derived from various parts of the human body:

1 inch = the length of the first joint of a man's thumb.

1 foot = the length of a man's foot.

1 yard = the distance from the point of a man's nose to the end of his thumb.

1 rod = the length obtained by 16 men standing one behind the other.

1. *For study.* Mrs. Badger made 3 quarts of grape marmalade which she put into pint jars. How many glasses did she use?

1 qt. = 2 pints.
3 × 2 pints = 6 pints.

Mrs. Badger used 6 pint glasses.

2. Change to the next lower unit of measurement:

(1) 1 ft.
(2) 3 qt.
(3) 1 lb.
(4) 3 wk.
(5) 2 hr.
(6) 3 oz.
(7) 1 sq. ft.
(8) $\frac{3}{4}$ gal.
(9) $\frac{5}{8}$ lb.
(10) $\frac{11}{12}$ da.
(11) $1\frac{2}{3}$ sq. yd.
(12) $2\frac{1}{2}$ bu.
(13) $\frac{3}{4}$ yd.
(14) $\frac{3}{4}$ gross
(15) $\frac{2}{3}$ yd.

15.* *Reducing Decimals to Common Fractions in their Lowest Terms.*

1. *For study.* .36 = ?

$$.36 = \frac{36}{100}$$

$$\frac{36 \div 4}{100 \div 4} = \frac{9}{25}$$

2. .86
3. .48
4. .56
5. .74
6. .64
7. .92

16. *Oral Exercises.*

1. At $6\frac{1}{4}$¢ per yard, how many yards of braid can be bought for 50¢?

2. How many pint packages can be made from 1 pk. 1 qt. of seeds? 18 packages

3. .4 − .08 = ?

4. How much will 6 yards of cloth cost if one yard costs $\$\frac{3}{5}$? Give cost of 9 yards.

5. Three quarts are what part of one bushel?

6. At 3 for 5¢, how many pencils can be bought for 35¢?

7. A boy buys papers at $1.25 per hundred and sells them at 2¢ each. How much does he make on 100 papers?

8. What is the total length of 9 boards if each board is $4\frac{2}{3}$ feet in length?

9. A farmer owns 27 acres and plants $\frac{5}{9}$ of his farm in wheat. How many acres does he plant in wheat?

10. What is $\frac{2}{3}$ of $2100?

11. To 20 gallons of coffee add 5 gallons of water. What part of the mixture is coffee?

12. Mary spelled $\frac{19}{20}$ of the lesson correctly and Florence missed $\frac{1}{5}$ of it. Which had the more perfect lesson?

13. A spring yields 50 gallons of water daily. How many gallons does it yield during October?

14. Oranges bought at 2 for 5 cents are sold at 5 for a quarter. How much will a boy make on $\frac{1}{2}$ dozen oranges?

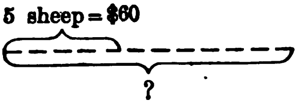
15. Bought a dwelling for $5000 and sold it at a profit of $\frac{1}{4}$. What did I sell it for?

16. How many square yards in a lawn 15 feet wide and 45 feet long?

17. Two women receive $2.40 for making button holes. One makes 20 and the other 60. How shall they divide the money?

17.* *Finding the Value of the Whole when that of a Part is Given — Integers.*

1. *For study.* Robert owned 12 sheep. He sold 5 of them for $60. How much were all his sheep worth?



Analysis

5 sheep = $60
1 sheep = $60 ÷ 5 = $12
12 sheep = 12 × $12 = $144
All of Robert's sheep were worth $144.

This type of problem (obtaining the whole from a part) is often deferred until the class has reached percentage and it is then found very difficult to master. If the class see it applied to integers first, as here, they will have little difficulty in grasping the principle. The later applications to fractions and percentage follow naturally. Make sure that the pupils recognize that obtaining *the whole from a part* is but the reverse of obtaining *the part from the whole* (compare with exercise 53, page 35). The application of the principle to fractions will be found on page 147, exercise 31.

2. If $85 pays the rent of a house for 5 months, what is the rent for a year?

3. A dressmaker cut 3 yards of velvet from a piece containing 7 yards. She sold the 3 yards to a customer for $6. At that price what was the value of all the velvet to the dressmaker?

4. A grocer had 15 barrels of flour in his store-room. He sold 8 of them for $96. How much was all his flour worth at that rate?

5. During one month a department store sold 8 victrolas of the same model for $600. They had 3 victrolas left. What was the value of their whole stock?

6. A farmer sold 6 acres out of a tract of land containing 15 acres. He received $9000. At this price, what was the whole tract worth?

7. If 3 lb. of candy cost $1.80, how much will 5 lb. cost?

Continue.

18.* *Denominate Numbers — Reduction Ascending.*

1. *For study.* One Saturday, Bob, the market boy, sold 50 pecks of sweet potatoes. How many bushels did he sell?

4 pk. = 1 bu.
50 pk. ÷ 4 pk. = $12\frac{1}{2}$ times
Bob sold $12\frac{1}{2}$ bushels of sweet potatoes.

2. Change to the next higher unit:

(1) 36 hr.
(2) 32 oz.
(3) 21 da.
(4) 9 ft.
(5) 7 gills
(6) 13 qt. (liq.)
(7) 13 qt. (dry)
(8) 18 mo.
(9) 17 pk.
(10) 11 yd.
(11) 26 wk.
(12) 32 in.
(13) 28 oz.
(14) 11 pk.
(15) 27 pt.
(16) 15 mo.

19. *Find quotient:*

1. $7\overline{)468\frac{1}{8}}$
2. $5\overline{)234\frac{1}{6}}$
3. $6\overline{)701\frac{1}{7}}$
4. $8\overline{)365\frac{1}{3}}$
5. $5\overline{)273\frac{3}{4}}$.
6. $9\overline{)484\frac{1}{5}}$
7. $7\overline{)654\frac{1}{2}}$
8. $4\overline{)942\frac{2}{3}}$
9. $8\overline{)357\frac{5}{7}}$
10. $3\overline{)575\frac{2}{8}}$
11. $6\overline{)791\frac{3}{9}}$
12. $4\overline{)759\frac{1}{5}}$
13. $7\overline{)619\frac{4}{8}}$
14. $9\overline{)767\frac{2}{8}}$
15. $6\overline{)598\frac{2}{4}}$
16. $3\overline{)569\frac{1}{7}}$

20. *Find the product:*

1. $\begin{array}{r}687\frac{1}{3}\\ \underline{75}\end{array}$
2. $\begin{array}{r}498\\ \underline{89\frac{1}{6}}\end{array}$
3. $\begin{array}{r}679\frac{1}{7}\\ \underline{63}\end{array}$
4. $\begin{array}{r}585\\ \underline{47\frac{1}{5}}\end{array}$
5. $\begin{array}{r}856\frac{1}{4}\\ \underline{96}\end{array}$
6. $\begin{array}{r}693\\ \underline{96\frac{1}{9}}\end{array}$
7. $\begin{array}{r}842\frac{1}{4}\\ \underline{68}\end{array}$
8. $\begin{array}{r}789\\ \underline{59\frac{1}{3}}\end{array}$
9. $\begin{array}{r}527\frac{1}{3}\\ \underline{78}\end{array}$
10. $\begin{array}{r}765\\ \underline{87\frac{1}{5}}\end{array}$

21. *Give result at sight:*

1. $8\frac{2}{5} \div 6$
2. $3\frac{1}{4} + 4\frac{3}{8}$
3. $5 \times 2\frac{1}{3}$
4. $3\frac{1}{5} \div 4$
5. $7 \div \frac{3}{4}$
6. $9\frac{1}{2} - \frac{7}{8}$
7. $5\frac{5}{9} \div 2$
8. $5\frac{5}{6} + 2\frac{1}{3}$
9. $4 \times \frac{7}{8}$
10. $9 \div \frac{6}{7}$
11. $9\frac{3}{4} \div 3$
12. $1\frac{2}{3} - \frac{5}{6}$
13. $\frac{2}{3} \div \frac{5}{6}$
14. $8\frac{2}{3} \div 2$
15. $5\frac{4}{5} \div 3$
16. $7 \times \frac{8}{9}$
17. $5\frac{2}{3} + 1\frac{3}{4}$
18. $4\frac{1}{6} \div 5$
19. $6\frac{1}{3} - 4\frac{5}{6}$
20. $8 \times \frac{7}{8}$
21. $8\frac{1}{3} \div 5$

22.* *Multiplication of an Integer by a Fraction.*

Preliminary Exercise.

a. $1 \times 12 = 12$
$\frac{1}{2} \times 12 = 6$
b. $1 \times 6 = 6$
$\frac{1}{3} \times 6 = 2$

c. $1 \times 8 = ?$
$\frac{1}{4} \times 8 = ?$
d. $1 \times 20 = ?$
$\frac{1}{5} \times 20 = ?$ Continue.

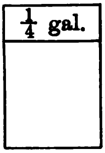
Can you make a rule for the above?

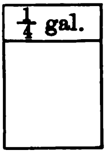
In multiplying by a fraction the sign × is usually read "of."

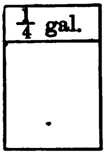
1. *For study.* (*Dramatize.*) One day in May, Roger picked 3 gallons of raspberries for his grandfather, who gave him in payment $\frac{1}{4}$ of all the berries he picked. What quantity of raspberries did he receive in payment?

Solution by Integers	Solution by Common Fractions
3 gal. = 12 qt.	$\frac{1}{4}$ of 3 gal. = $\frac{3}{4}$ gal.
$\frac{1}{4}$ of 12 qt. = 3 qt.	

Roger received 3 quarts or $\frac{3}{4}$ of a gallon of raspberries.



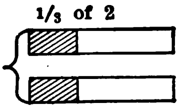


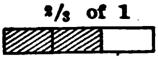


2. John can drive to his grandfather's farm in 4 hours. If he has driven $\frac{1}{5}$ of the way by 9 o'clock, how long has he been on the road?

3. Give answers to the following. Illustrate any two by drawing or by cutting:

a. $\frac{1}{3} \times 2$ = what part of 1?
b. $\frac{1}{5} \times 4$ = what part of 1?
c. $\frac{1}{7} \times 6$ = what part of 1?
d. $\frac{1}{4} \times 3$ = what part of 1?
e. $\frac{1}{8} \times 7$ = what part of 1?





23.* *Multiplication of an Integer by a Fraction — continued.*

1. *For study.* Paul walked to the village in 2 hours. Francis rode his bicycle and made the distance in $\frac{3}{5}$ of that time. How long did it take Francis?

Analysis by Integers

2 hr. = 120 min.
$\frac{1}{5} \times 120$ min. = 24 min.
$\frac{3}{5} \times 120$ min. = 3×24 min.
= 72 min.
72 min. = 1 hr. 12 min.

Analysis by Common Fractions

$\frac{1}{5} \times 2$ hr. = $\frac{2}{5}$ hr.
$\frac{3}{5} \times 2$ hr. = $3 \times \frac{2}{5}$ hr. = $\frac{6}{5}$ hr.
$\frac{6}{5}$ hr. = $1\frac{1}{5}$ hr.

Write

$$\frac{3}{5} \times 2 \text{ hr.} = \frac{3 \times 2}{5} = \frac{6}{5} \text{ hr. or } 1\frac{1}{5} \text{ hr.}$$

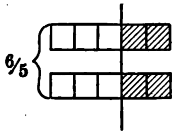
It took Francis $1\frac{1}{5}$ hr. to make the trip on his bicycle.

2. What must be paid for $\frac{5}{6}$ of a yard of velvet at $2 a yard?

3. James Morris intended to practice 2 hours on his violin. He practiced only $\frac{3}{4}$ of the time. How long did he practice?

Illustrate the following by drawing:

4. *For study.* $\frac{3}{5} \times 2 = \frac{6}{5}$ or $1\frac{1}{5}$.



5. $\frac{5}{6} \times 3$

6. $\frac{4}{5} \times 4$

7. $\frac{3}{7} \times 5$

8. $\frac{4}{5} \times 3$

9. $\frac{2}{6} \times 4$

10. $\frac{6}{7} \times 3$

24. *Written Problems.*

1. A man tries to overtake a street car which is 20 feet ahead of him. If he runs 12 feet a second and the car runs 8 feet a second, how soon will he overtake the car?

2. I earned $\$12\frac{3}{4}$ one week, $\$9\frac{7}{10}$ the next, $\$14\frac{4}{5}$ the next, $\$10\frac{1}{2}$ the last week. How much did I earn in the month?

3. I bought an automobile for $1850 and sold it for $\frac{4}{5}$ of its cost. How much did I lose on it? Shortest way.

4. At $\$\frac{3}{8}$ a yard, how much linen can be bought for $3?

5. Mrs. Kessler bought 15 yards of silk at $\$2\frac{7}{8}$ a yard and 7 yards of lace at $\$3\frac{1}{2}$ a yard. What was the whole cost?

6. A farmer sold $\frac{4}{5}$ of his land and had 63 acres left. How many acres did he sell? Diagram.

7. A man sold a horse for $\$120\frac{3}{4}$ and thereby lost $\$9\frac{7}{8}$. How much did the horse cost?

8. A lady having $50 paid $\$12\frac{1}{2}$ for a hat and $\$17\frac{5}{8}$ for a wrap. How much money had she left?

9. Mr. Adams owned $\frac{3}{4}$ of a factory. He sold $\frac{1}{3}$ of the factory to Mr. White and $\frac{1}{4}$ of it to Mr. Otto. What part of the factory had he left?

10. If 8 yards of lace cost $\$3\frac{1}{5}$, how much will 12 yards cost?

11. There are $192\frac{7}{10}$ barrels of water in a cistern which will hold $521\frac{2}{15}$ barrels. How much does the cistern lack of being full?

12. Charles earned $\$2\frac{7}{10}$ a week delivering papers. How much did he earn in 5 weeks?

13. How many pounds in $\frac{5}{8}$ of a barrel of flour? 196 pounds of flour are in 1 barrel.

14. What is the cost of 7 yards of broadcloth at $\$4\frac{1}{4}$ a yard?

15. How many yards of cloth at $\$3\frac{3}{4}$ a yard can be bought for $\$2\frac{1}{2}$?

16. On a map of the United States measure the length of a straight line between your home and a neighboring large city and then calculate the distance in miles by using the scale of the map. Ascertain from a railroad office the length of a railroad that connects the two places. Why does it differ from the distance which you found?

17. If $3\frac{1}{2}$ inches are folded in for a hem on each side of a piece of veiling which is a yard wide, how wide is the veil?

18. Frank is 3 feet 9 inches high and Donald is $\frac{2}{3}$ of a foot taller. How tall is Donald?

19. The state of Delaware contains 2050 square miles. How many states the size of Delaware could be made from Texas, the area of which is 265,780 square miles?

20. Mr. Allen raised 25 bushels of potatoes on $\frac{1}{5}$ of an acre. At that rate how many bushels could he have raised on 8 acres?

21. Four boys went fishing. Of the total catch Harold caught $\frac{2}{9}$, Merrill $\frac{1}{4}$, Stanley $\frac{1}{3}$. What part did Norman catch? Diagram.

22. How many square inches are there in a page which is 12 inches long and $8\frac{1}{4}$ inches wide?

23. Write the number of days in each month of the year.

24. Mr. Baldwin owned 130 acres of land. He sold $54\frac{7}{8}$ acres to Mr. Insley and $32\frac{3}{4}$ acres to Mr. Korbly. How many acres had he left?

25. A grocer bought $10\frac{1}{2}$ bushels of potatoes which he put into bags containing $\frac{3}{4}$ of a bushel each. How many bags were there?

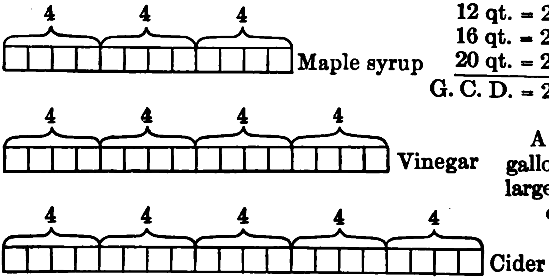
26. Make an original problem about a baseball team that the class can solve without pencil.

27. How can you tell the number of inches in one square foot from knowing the number of inches in one linear foot? Write the table of linear measure and that of square measure side by side.

25.* *The Greatest Common Divisor or Factor.*

1. *For study.* A child's nursery 21 feet long and 15 feet wide has a stencil painted round the top of its walls. Construct a room to scale from cardboard and show how long may be the pattern shown above, so that when repeated it will fill each side exactly.

2. *For study.* A farmer has 12 quarts of maple syrup, 16 quarts of vinegar and 20 quarts of cider. What is the largest uniform size can which he can use that will bottle all of his liquids without waste?



Solution

$$\begin{array}{r}12\text{ qt.} = 2\text{ qt.} \times 2 \times 3\\ 16\text{ qt.} = 2\text{ qt.} \times 2 \times 2 \times 2\\ \underline{20\text{ qt.} = 2\text{ qt.} \times 2 \times 5}\\ \text{G. C. D.} = 2\text{ qt.} \times 2 = 4\text{ qt.}\end{array}$$

A four-quart or gallon can is the largest can which he can use.

It will be seen that while 2 is a factor found in all three of the numbers (a common factor, therefore), that 2 × 2 is also common. Four is not only a greater factor of 12, 16 and 20 but the greatest common factor.

3. Anna has 3 ribbons, 8 feet, 12 feet and 16 feet long respectively, which she wishes to cut without waste into shorter ribbons of equal length and as long as possible. What will be the length of the shorter ribbons?

4. A farmer has 125 bushels of corn, 200 bushels of wheat, and 175 bushels of barley, which he wishes to haul away separately in loads of equal size and as large as possible; how many bushels can he haul at a load?

5. A man has three balls of fishing twine containing 120 feet, 160 feet, and 200 feet which he desires to cut into fishing lines of equal length, making them as long as possible. How long must the lines be cut?

6. A speculator bought three tracts of land containing 240 acres, 320 acres, and 400 acres which he wishes to divide into small farms of equal size, making them as large as possible. How many acres must he put into each farm?

26. *Find the G. C. D. of:*

1. 24 and 36.
2. 24 and 28.
3. 30 and 45.
4. 36 and 90.
5. 72, 84 and 96.
6. 56, 63 and 84.
7. 64, 72 and 88.
8. 24, 72 and 144.

27. *Reduce to common fractions in their lowest terms:*

1. .75
2. .36
3. .48
4. .82
5. .60
6. .72
7. .34
8. .52
9. .85
10. .96
11. .90
12. .46
13. .26
14. .65
15. .72
16. .50
17. .42
18. .80
19. .38
20. .25

28. *Subtract:*

1. $\begin{array}{r} 4714\frac{3}{8} \\ \underline{2987\frac{5}{6}} \end{array}$

2. $\begin{array}{r} 7210\frac{3}{7} \\ \underline{5846\frac{5}{9}} \end{array}$

3. $\begin{array}{r} 6743\frac{2}{3} \\ \underline{4986\frac{4}{7}} \end{array}$

4. $\begin{array}{r} 4015\frac{5}{8} \\ \underline{2879\frac{6}{7}} \end{array}$

5. $\begin{array}{r} 7602\frac{1}{6} \\ \underline{5874\frac{5}{9}} \end{array}$

6. $\begin{array}{r} 5113\frac{2}{5} \\ \underline{3879\frac{5}{8}} \end{array}$

7. $\begin{array}{r} 8120\frac{5}{8} \\ \underline{7964\frac{5}{6}} \end{array}$

8. $\begin{array}{r} 6213\frac{5}{9} \\ \underline{4927\frac{7}{8}} \end{array}$

9. $\begin{array}{r} 9315\frac{5}{7} \\ \underline{6897\frac{4}{5}} \end{array}$

29. *Read aloud. Find the sum:*

1. 107,609.007 + 7,856.0705 + 60,975.9683.
2. 697,857.06758 + 38,074.076009 + 259,783.00003.

30. *Meadowbrook Farm: XI — Spraying — Oral.*

1. Mr. Henderson bought a spraying mixture for his apple orchard: 8 lb. lime at $1\frac{1}{4}$¢ a pound, 6 lb. copper sulphate at 22¢ a pound. Cost?

2. Mr. Henderson found that the trees which were sprayed yielded on the average 5.8 bushels of apples to the tree; and that the trees which were not sprayed yielded only 3.8 bushels each. How much was gained on each tree?

3. He estimated that the spraying cost 5¢ a bushel. If the apples were worth $3 a bushel, what was the net profit of one tree due to spraying?

4. The first year Mr. Henderson planted one acre in potatoes which yielded him 68 bushels. He sold $\frac{3}{4}$ of his crop at $2 a bushel. How much did he receive for them?

5. The second year he sprayed his potatoes with Paris green at 75 cents a pound, using $1\frac{1}{2}$ pounds. He paid a laborer $2.25. What was the entire cost of spraying the potatoes?

6. The potato patch yielded not only 120 bushels after being sprayed, but the quality of the potatoes was also improved. What was the value of the crop at $2.20 a bushel?

7. Mr. Henderson found that he could buy a spraying mixture already prepared in a 30-gallon barrel at a cost of $3.60. He could make his own mixture for spraying at $2\frac{1}{2}$ cents a quart. Which was the cheaper thing for him to do and how much?

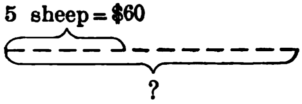
8. From the 30 gallon barrel Mr. Henderson used 17 quarts the first day. What quantity remained?

31.* *Finding the Value of the Whole when that of a Part is Given — Fractions.*

1. *For study.*

a. A man had a drove of 12 sheep. He sold 5 of them for $60. At this rate what was the whole drove worth?

Solution by Integers



Value of 12 sheep = ?

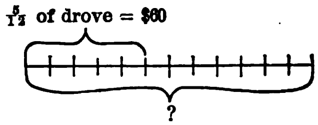
Analysis

5 sheep = $60
1 sheep = $60 ÷ 5 = $12
12 sheep = 12 × $12 = $144

The whole drove of sheep was worth $144.

b. A man sold $\frac{5}{12}$ of a drove of sheep for $60. At this rate what was the whole drove worth?

Solution by Fractions



Value of drove = ?

Analysis

$\frac{5}{12}$ of drove = $60
$\frac{1}{12}$ of drove = $60 ÷ 5 = $12
$\frac{12}{12}$ of drove = 12 × $12 = $144

The whole drove of sheep was worth $144.

2. Solve with integers and with fractions: If $85 pays the rent of a house for 5 months ($\frac{5}{12}$ of a year), what is the rent for a year?

3. If $\frac{2}{3}$ of a journey can be made in 18 hours, how many hours will be required to make the whole journey?

4. A farmer sold $\frac{4}{5}$ of his crop of potatoes for $120. How much was the entire crop worth?

Make sure that the pupils see that problems of this type are the reverse of the type presented in exercise 53 on page 35. Require the class to make problems of the type presented on this page (part given to find the whole) by working backward from the answers to the problems on page 35. Before attempting this, reverse the problems in this exercise by getting the part from the whole. Continue until one process is no more difficult than the other. For example:

(*a*) If $\frac{5}{6}$ of a yard of velvet costs $2.50, how much does a yard cost?
(*b*) If a yard of velvet costs $3, how much will $\frac{5}{6}$ of a yard cost?

32.* *Multiplication of an Integer by a Fraction — concluded.*

See previous lessons, pp. 140, 141.

Preliminary Exercise with Integers.

$8 \times 2 \times 3 = 48$ $\qquad ? \times 2 \times 8 = 48$

$2 \times 3 \times ? = 48$ $\qquad 3 \times ? \times 2 = 48$

Continue.

> *Complete and learn:*
>
> It does not change the —— of the product to change the order of the factors.

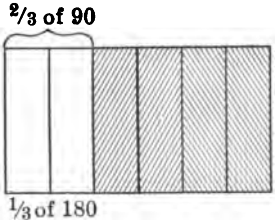
1. *For study.* Mr. Forsythe owned 2 adjoining lots on Meridian Street with a frontage of 90 feet each. The city purchased from him $\frac{2}{3}$ of his south lot for a roadway. How many feet did the city purchase? What part of all his ground did he sell?

Two Solutions:

a. $\frac{1}{3} \times 90 \text{ ft.} \times 2 = 60 \text{ ft.}$ (Solution by analysis)

b. $2 \times 90 \text{ ft.} \times \frac{1}{3} = 60 \text{ ft.}$ (Solution changing the order of factors)

or



$$\frac{2}{3} \times 90 \text{ ft.} = \frac{2 \times 90 \text{ ft.}}{3} = 60 \text{ ft.}$$

$$\frac{2}{3} \text{ of } 90 \text{ ft.} = \frac{1}{3} \text{ of } 180 \text{ ft.}$$

The city purchased 60 feet or $\frac{1}{3}$ of all his ground.

2. *For study.* Prove that $\frac{2}{5} \times 50 = \frac{1}{5} \times 100$.

a. $\frac{2}{5} \times 50 = \frac{1}{5} \times 50 \times 2 = 20$

b. $\frac{2}{5} \times 50 = 2 \times 50 \times \frac{1}{5} = 20$

Write

$$\frac{2}{5} \times 50 = \frac{2 \times 50}{5} = 20$$

3. Solve in two ways:

a. $\frac{3}{8} \times 16$ $\qquad$ *b.* $\frac{3}{5} \times 40$ $\qquad$ *c.* $\frac{6}{7} \times 18$ $\qquad$ *d.* $\frac{5}{8} \times 24$

$\frac{5}{8} \times 24$ $\qquad$ $\frac{4}{9} \times 36$ $\qquad$ $\frac{3}{10} \times 14$ $\qquad$ $\frac{5}{7} \times 21$

33. *Mr. Johnson's Restaurant: IV — Bills — Written.*

1. *For study.*

Chicago, August 1, 1920.

Mr. W. H. Johnson,

Bought of Ballard Dairy Co.

214 South State Street.

July 30	20 lb. butter	@	\$ $.62^{1}/_{2}$
	$8^{1}/_{2}$ gal. cream	@	1.50
	$5^{1}/_{4}$ lb. cheese	@	.40
	$10^{1}/_{2}$ gal. milk	@	.28

Received payment

Ballard Dairy Co.

per W.

a. Name the creditor in the above bill; the debtor.

b. What does the sign @ mean? *c.* What does the "per W" mean? *d.* What is the amount of the bill?

2. Make out and receipt a bill to Mr. Johnson by the Soft Water Laundry Company for 50 tablecloths at 20¢ each and 40 dozen napkins at 22¢ a dozen.

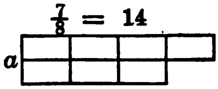
3. He purchased from Korbly & Co., Jewelers, 8 dozen spoons at \$9.75 and 7 dozen plated forks at \$4.20. Make out and receipt the bill, with yourself as bookkeeper in the jewelry store.

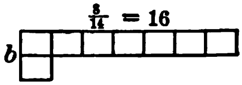
4. Bring to school the page from your daily paper on which appear the market reports. With this before you, make out a bill for coal, a bill for fruit, a bill for vegetables and one for meat which Mr. Johnson might have ordered.

5. Make out and receipt a bill for 12 tons of coal at \$9.25, supplying names, date, etc.

34. *Suggestive Questions in Fractions.*

1. Copy each of the following figures and complete it so as to make an oblong. In each case give the value of the oblong.





2. What is the value of the whole when:

a. $\frac{3}{4}$ of the whole = 6? *c.* $\frac{6}{9}$ of the whole = 12?
b. $\frac{2}{3}$ of the whole = 8? *d.* $\frac{4}{5}$ of the whole = 8?

3. Change to a fraction of a dollar:

a. 1¢ *b.* 5¢ *c.* 25¢ *d.* 40¢ *e.* 65¢

4. Change to a fraction of a pound:

a. 1 oz. *b.* 2 oz. *c.* 8 oz. *d.* 9 oz. *e.* 12 oz.

5. Change to a fraction of a year:

a. 1 mo. *b.* 2 mo. *c.* 4 mo. *d.* 3 mo. *e.* 5 mo.

35.* *Find the product:*

1. *For Study.*

693
$75\frac{2}{3}$
3)1386 (2 × 693)
462
3465
4851
52,437

2. 518
$58\frac{4}{7}$

3. 876
$59\frac{5}{6}$

4. 365
$85\frac{2}{5}$

5. 972
$45\frac{3}{4}$

6. 972
$43\frac{5}{6}$

7. 896
$65\frac{2}{7}$

8. 848
$96\frac{7}{8}$

9. 882
$48\frac{4}{9}$

10. 791
$73\frac{5}{7}$

11. 847
$48\frac{3}{7}$

12. 792
$89\frac{5}{8}$

13. 965
$78\frac{2}{5}$

36.

1. What is $\frac{3}{4}$ of 24?
2. 24 is $\frac{3}{4}$ of what number?
3. What is $\frac{5}{9}$ of 45?
4. 45 is $\frac{5}{9}$ of what number?
5. 63 is $\frac{9}{7}$ of what number?
6. What is $\frac{9}{7}$ of 63?
7. 56 is $\frac{7}{8}$ of what number?
8. What is $\frac{8}{7}$ of 56?
9. 42 is $\frac{7}{6}$ of what number?
10. 42 is $\frac{6}{7}$ of what number?
11. What is $\frac{6}{7}$ of 42?
12. What is $\frac{9}{8}$ of 72?

Continue.

Require analysis and diagram if child fails.

37.* *Dividing by a Mixed Number — at sight:*

1. *For study.* Mr. Allison paid a laborer \$12 for work at $\$2\frac{2}{3}$ a day. How many days did the man work?

Solution

$\$2\frac{2}{3} = \$\frac{8}{3}$

$\$12 = \$\frac{36}{3}$

$\$\frac{36}{3} \div \$\frac{8}{3} = 4\frac{1}{2}$ times

The laborer worked $4\frac{1}{2}$ days.

2. If it requires $5\frac{1}{3}$ yards of cloth for a skirt, how many skirts may be made from 24 yards?

3. $5 \div 1\frac{2}{3}$
4. $3 \div 1\frac{2}{5}$
5. $5 \div 2\frac{3}{4}$
6. $7 \div 2\frac{1}{4}$
7. $8 \div 3\frac{2}{7}$
8. $7 \div 1\frac{4}{9}$
9. $4 \div 2\frac{3}{7}$
10. $6 \div 2\frac{1}{5}$
11. $3 \div 2\frac{1}{4}$
12. $9 \div 4\frac{3}{5}$
13. $8 \div 1\frac{5}{6}$
14. $9 \div 5\frac{1}{2}$

38. *Find the sum:*

1.	**2.**	**3.**	**4.**
$472\frac{2}{3}$	$298\frac{7}{8}$	$876\frac{5}{7}$	$689\frac{5}{7}$
$695\frac{5}{48}$	$763\frac{11}{12}$	$984\frac{11}{12}$	$862\frac{3}{28}$
$876\frac{11}{12}$	$492\frac{1}{24}$	$685\frac{3}{42}$	$473\frac{7}{8}$
$594\frac{7}{24}$	$989\frac{7}{72}$	$875\frac{5}{6}$	$695\frac{5}{14}$
$758\frac{3}{4}$	$678\frac{4}{9}$	$978\frac{8}{21}$	$256\frac{1}{2}$
$697\frac{7}{8}$	$473\frac{13}{48}$	$697\frac{1}{2}$	$789\frac{3}{7}$
$579\frac{5}{6}$	$984\frac{3}{4}$	$389\frac{5}{14}$	$697\frac{3}{4}$
$845\frac{9}{16}$	$898\frac{5}{6}$	$687\frac{2}{3}$	$878\frac{3}{8}$

39. *Written Problems.*

1. A fruit dealer sells 9 dozen oranges at the rate of 2 for 5¢. For what does he sell all of them?

2. How far can Arthur walk in 4 hours, if he walks $3\frac{7}{8}$ miles an hour?

3. Make out and receipt a bill for: 1 rug @ $7.50; 1 overcoat @ $35; $7\frac{1}{2}$ yards of serge @ $2.

4. The mercury in a thermometer which registered 16 degrees below zero outdoors rose to 68 degrees when carried into the house. How many degrees had it risen?

5. On a counter in a dry goods store were five pieces of cloth. The first contained 37.5 yards, the second 26.75 yards, the third 14.375 yards, the fourth 36.5 yards and the fifth .125 yard. How many yards in the five pieces?

6. A man traveled $\frac{7}{12}$ of his journey the first day, $\frac{3}{8}$ of it the second and then had 25 miles to travel. How long was the journey?

7. The earth turns about on its axis once in 24 hours. How far is a place on the equator carried in one hour? The length of the equator is 25,000 miles.

8. The United States coins weigh as follows: one cent 48 grains, five cents $73\frac{1}{6}$ grains, dime $38\frac{7}{12}$ grains, quarter-dollar $96\frac{9}{20}$ grains, half-dollar $192\frac{9}{10}$ grains, dollar $412\frac{1}{2}$ grains, quarter-eagle $64\frac{1}{2}$ grains, half-eagle 129 grains, eagle 258 grains, double-eagle 516 grains. What is the total weight?

9. How many square feet are there in a floor which is 11 feet wide and $12\frac{1}{2}$ feet long?

10. Marshall was 16 years old. His age was $\frac{4}{5}$ of Drew's age. How old was Drew? Diagram.

11. A suit of clothes was marked at $48. This was $\frac{1}{2}$ more than the cost. What was the cost?

12. Find the sum of: Sixty-one thousandths; eight and seven hundred six thousandths; nine thousand seven hundred eighty-six.

13. If it takes 7 yards of gingham to make 4 aprons, how many aprons will 42 yards of gingham make?

14. A man builds a house which has a width of 38 feet and a depth of 32 feet. How many square feet of the lot are covered by the house?

15. From a piece of cloth measuring $28\frac{1}{2}$ yards, there have been sold $2\frac{2}{3}$ yards, $6\frac{5}{8}$ yards, $13\frac{3}{4}$ yards. What is the remainder?

16. Write in figures: one hundred million ten thousand eleven. Write in words: $44\frac{5}{12}$; XCIV.

17. A baker has $\frac{2}{3}$ of a fruit cake and $\frac{3}{4}$ of a nut cake baked in pans of the same size. He wishes to cut both cakes into pieces of equal size. What is the largest size into which he can cut them? How many pieces will the nut cake make?

18. A rug is 9 feet long. The width is $\frac{3}{4}$ of the length. How many square feet in the surface of the rug?

19. A farmer has 3 five-pound chickens, which he wishes to exchange for sugar at 20 cents a pound. If chickens are worth 36 cents a pound, how many pounds of sugar can he buy?

20. On one bunch of bananas there remain 36. This is $\frac{1}{2}$ of the entire bunch. How many bananas on the bunch at first? What did I receive for those sold at the rate of three for a dime?

21. What is the cost of crushing 2 tons of ore at $\$1\frac{3}{10}$ per ton?

22. How many yards of ribbon at $\$\frac{3}{4}$ a yard can be bought for $2?

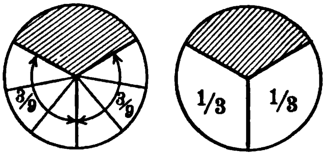
23. A hotel uses $25\frac{3}{4}$ pounds of beef in a day. What will be the weekly bill at 33 cents a pound?

24. Write an original problem about selling Christmas greens.

40.* *Reduction of Fractions to Lower Terms.*

1. *For study.* $\frac{6}{9} = \frac{?}{3}$

$$\frac{6 \div 3 = 2}{9 \div 3 = 3}$$



Complete and learn:

It does not affect the —— of a fraction to divide both its terms by the same number.

Make sure that the pupils see that while the size of the parts increases three fold (9ths to 3ds) only one third of the number of parts is taken.

Note also that in the reduction of fractions to equivalent fractions of another denomination the fraction is divided by the equivalent of 1. For example:

$$\frac{6 \div 3 = 2}{9 \div 3 = 3}\left(\frac{3}{3} = 1\right)$$

2. By drawing show that:

a. $\frac{8}{12} = \frac{2}{3}$ *b.* $\frac{9}{12} = \frac{3}{4}$ *c.* $\frac{6}{8} = \frac{3}{4}$

3. Reduce to lowest terms by the use of factoring and of cancellation:

(1) *For study.*

Think: $\frac{26}{65} = \frac{2 \times \cancel{13}}{5 \times \cancel{13}}$

Write: $\frac{26}{65} = \frac{2}{5}$

(2) $\frac{84}{96}$
(3) $\frac{33}{121}$
(4) $\frac{60}{75}$
(5) $\frac{42}{70}$
(6) $\frac{52}{98}$
(7) $\frac{78}{91}$
(8) $\frac{75}{105}$
(9) $\frac{55}{99}$

Complete and learn:

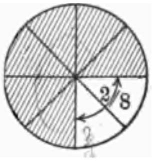
To reduce a fraction to its lowest terms cancel all —— factors from its numerator and its denominator. The remaining factors will be the numerator and denominator, respectively, of the fraction in its lowest terms.

41.* *Multiplication of a Fraction by an Integer — Dividing the Denominator.*

1. *Dramatize.* Mr. and Mrs. Brennan took luncheon at a restaurant. For dessert, Mrs. Brennan ordered apple pie and ice cream. She received $\frac{1}{8}$ of a pie with her cream. Mr. Brennan, who ordered apple pie only, received twice the amount served to his wife. How much pie was served to Mr. Brennan?

For study.

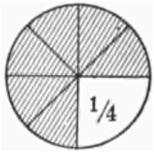
a. $2 \times \frac{1}{8}$ pie $= \frac{2 \times 1}{8}$ pie $= \frac{2}{8}$ of a pie.



The numerator was —— by 2.

b. $2 \times \frac{1}{8}$ pie $= \frac{1}{8 \div 2}$ pie $= \frac{1}{4}$ of a pie.

The denominator was —— by 2.



Mr. Brennan was served with $\frac{1}{4}$ of a pie.

2. What will 2 books cost at \$$\frac{1}{4}$ each? Two ways.

3. What will 2 yards of ribbon cost at \$$\frac{1}{6}$ a yard? Two ways.

4. Anna practiced her music lesson 4 times on Monday, spending $\frac{1}{4}$ of an hour at the piano each time. How long did she practice in all? Two ways. Continue.

Complete and learn:

To multiply a fraction by an integer —— the numerator or —— the denominator by the integer.

42. *At sight:*

1. $2 \times 3\frac{3}{4}$
2. $\frac{3}{4} \times 36$
3. $3 \times 4\frac{1}{2}$
4. $\frac{4}{5} \times 25$
5. $3 \div \frac{2}{3}$
6. $\frac{6}{7} \div 3$
7. $4 \div \frac{3}{4}$
8. $\frac{8}{9} \div 4$
9. $2 \times 3\frac{1}{2}$
10. $\frac{6}{8} \times 48$
11. $5 \times 4\frac{1}{4}$
12. $\frac{5}{7} \times 42$
13. $6 \div 2\frac{1}{2}$
14. $\frac{12}{15} \div 6$
15. $7 \div 3\frac{1}{4}$
16. $\frac{14}{17} \div 7$

43. *Oral Problems.*

1. How long will it take one man to do a piece of work if it takes 6 men 18 days?

2. A second-hand dealer sold an old chest for $32. This was $\frac{4}{5}$ of what it originally cost. What was the original cost?

3. Dinner is to be served at 6 o'clock. At what time should a 4-pound beef roast be put into the oven if one allows 20 minutes for roasting each pound?

4. What is the product when the multiplicand is 3 and the multiplier is $\frac{3}{4}$?

5. James lives 8 blocks from school. This is $\frac{2}{3}$ of the distance to Frederick's house. How far does Frederick live? Alfred lives $\frac{3}{4}$ as far as Frederick. How far does Alfred live from school? Continue.

6. Rudolph is $4\frac{2}{3}$ feet tall and Theodore is $4\frac{3}{4}$ feet tall. Which is the taller and how much?

7. A man earned $3.50 a day for husking corn at 7¢ a bushel. How many bushels did he husk?

8. The battle of Lexington was fought in 1775. How many years ago was that?

9. A train left Chicago at 6:10 A.M. and arrived at its destination in 9 hours. At what hour did it arrive?

10. A grocer sold $\frac{3}{4}$ of a bushel of apples to one customer and 4 times that quantity to another. How much did he sell to the second customer?

11. If the apples in problem 10 were sold at 5 cents a pound, how much did he receive from each customer? (60 lb. = 1 bu.)

12. A lot on Meridian Street sold for $20,000. The lot is 50 feet wide. How much did it bring a front foot?

13. Francis is 10 years old today. How old is he in months? In weeks?

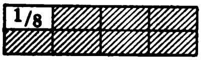
44.* *Multiplication of a Fraction by an Integer — Dividing the Denominator.*

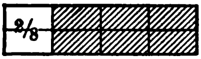
See previous lesson, p. 155.

Show by diagram:

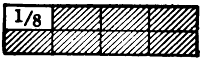
1. *For study.*

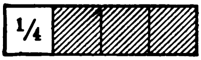
a. $2 \times \frac{1}{8} = \frac{2 \times 1}{8} = \frac{2}{8}$





b. $2 \times \frac{1}{8} = \frac{1}{8 \div 2} = \frac{1}{4}$





2. $2 \times \frac{1}{6}$ **3.** $4 \times \frac{1}{8}$ **4.** $3 \times \frac{1}{6}$ Continue.

Make sure that the class thoroughly understands that the numerator shows the number of parts and that the denominator shows the size of the parts.

45. *Suggestive Questions in Fractions.*

See previous lesson, p. 150.

1. Why does changing $\frac{1}{8}$ to $\frac{2}{8}$ double the value of the fraction?

2. Why does changing $\frac{1}{8}$ to $\frac{1}{4}$ double the value of the fraction?

3. What is the effect on the value of a fraction when both terms are multiplied by the same number? Illustrate. Are divided by the same number? Illustrate.

4. What is the effect on the value of a fraction when the numerator of the fraction is multiplied? Illustrate. When the denominator is divided? Illustrate.

5. What is meant by reducing to lowest terms?

46. *Written Dictation.*

1. Write in Arabic notation: MDCCLXXXIII.

2. Write in words: .00093. Write figures on the board.

3. At $\$\frac{4}{5}$ a yard, how many yards of flannel can be bought for $6?

4. How many quarts in $2\frac{3}{4}$ bushels?

5. A man spends $\frac{3}{5}$ of his salary and saves $30 a week. What is his salary for one week?

47. *An Easter Sale at the Florist's.*

1. Layman Brothers, Florists, opened a shipment of daffodils which contained 1800 extra fine at \$$3\frac{1}{2}$ per hundred. Cost?

2. Of the daffodils, $\frac{5}{6}$ were sold at 75¢ a dozen. How much was received for them? Diagram.

3. The remainder of the flowers were a total loss. What did Layman Brothers gain on the entire transaction?

4. Roy Bradford bought a bouquet for his mother consisting of: 2 bunches of violets at 50¢; $1\frac{1}{2}$ doz. lilies of the valley at \$1; $\frac{1}{2}$ doz. sprigs maiden hair fern at 50¢. What was the cost of the bouquet?

5. Mr. and Mrs. Sargent sent to some friends a basket of hyacinths for which they paid as follows: 1 birch basket at \$1.25; $1\frac{3}{4}$ yd. white tulle at 32¢; 6 hyacinths (mixed colors) at 35¢. What was the amount of the bill?

6. From a shipment of American Beauty roses, 240 roses were sold. This was $\frac{8}{9}$ of the entire shipment. How many roses remained unsold? Diagram.

7. The American Beauty roses unsold would have brought \$36. At that rate how much did Layman Brothers receive from the roses which they did sell?

8. If the entire shipment had cost \$250, what was their profit on the roses?

48.* *Multiplication of a Fraction by an Integer — Dividing the Denominator.*

See pp. 155, 157, for previous lessons.

1. *For study.* What will be the cost of 2 pounds of coffee at $\$\frac{3}{8}$ a pound?

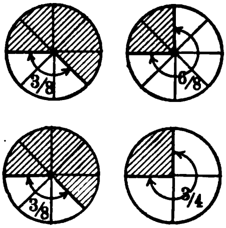
a. $2 \times \$\frac{3}{8} = \frac{2 \times \$3}{8} = \$\frac{6}{8}$ or $\$\frac{3}{4}$.

The numerator was —— by 2.

b. $2 \times \$\frac{3}{8} = \frac{\$3}{8 \div 2} = \$\frac{3}{4}$

The denominator was —— by 2.

Two pounds of coffee cost $\$\frac{3}{4}$.

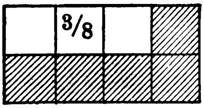


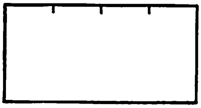
2. How much linen will be required to make 4 towels if each requires $\frac{5}{8}$ of a yard?

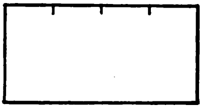
3. Three small gardens each contained $\frac{5}{6}$ of an acre of ground. How many acres in all 3 gardens?

4. Find cost of 4 bu. of potatoes at $\$1\frac{7}{8}$ per bu.

49. **1.** *a.* Shade the second rectangle so as to show $\frac{6}{8}$.
b. Shade the third rectangle so as to show $\frac{3}{4}$.







In which did you change the size of the parts? The number?

2. Multiply in two ways:

$2 \times \frac{5}{6}$
$5 \times \frac{3}{10}$
$6 \times \frac{7}{12}$
$8 \times \frac{5}{16}$
$7 \times \frac{3}{14}$
$4 \times \frac{5}{8}$
$8 \times \frac{5}{24}$
$9 \times \frac{7}{18}$
$3 \times \frac{5}{9}$
$4 \times \frac{5}{20}$
$7 \times \frac{4}{21}$
$6 \times \frac{8}{18}$
$9 \times \frac{10}{27}$
$3 \times \frac{11}{12}$
$4 \times \frac{3}{28}$
$5 \times \frac{7}{20}$

50.* *Reduction of Common Fractions to Decimals.*

1. *For study.*

a. $\frac{3}{4}$ = what decimal?

$1 = \frac{100}{100}$ or 1.00

$\frac{1}{4} = \frac{25}{100}$ or .25

$\frac{3}{4} = \frac{75}{100}$ or .75

b. $\frac{12}{30}$ = what decimal?

$$\frac{\overset{4}{\cancel{12}}}{\underset{10}{\cancel{30}}} = \frac{4}{10} \text{ or } .4$$

2. Reduce to tenths and write as a decimal:

a. $\frac{1}{2}$ *c.* $\frac{2}{5}$ *e.* $\frac{4}{5}$ *g.* $\frac{16}{40}$

b. $\frac{1}{5}$ *d.* $\frac{3}{5}$ *f.* $\frac{12}{20}$ *h.* $\frac{35}{50}$

3. Reduce to hundredths and write as a decimal:

a. $\frac{1}{20}$ *c.* $\frac{45}{50}$ *e.* $\frac{19}{25}$ *g.* $\frac{25}{50}$

b. $\frac{7}{20}$ *d.* $\frac{12}{25}$ *f.* $\frac{7}{10}$ *h.* $\frac{64}{200}$

4. Reduce to thousandths and write as a decimal:

a. $\frac{4}{25}$ *c.* $\frac{3}{8}$ *e.* $\frac{19}{40}$ *g.* $\frac{96}{3000}$

b. $\frac{1}{8}$ *d.* $\frac{5}{8}$ *f.* $\frac{12}{125}$ *h.* $\frac{240}{2000}$

51. *Suggestive Questions in Decimals.*

See previous lessons, pp. 109, 120.

1. Cancel all unnecessary ciphers: .1000; .0001; .0100.

2. Write in the order of value:

a.	*b.*	*c.*
.0101	.001	.10
.1010	.01	.1
.0010	.0001	.100
.1001	.1	.1000

3. How many ciphers would be used in the denominator if .003 were written as a common fraction?

4. Does it change the value of a decimal fraction to annex a zero?

5. Does it change the value of a decimal fraction to prefix a zero?

6. Which is greater: .036 or .360? .9675 or 1.2?

7. .1 is what part of 1.? .05 of 50?

8. Where is the decimal point written (or understood) in an integer?

52. *Home Budgets.*

1. The Treasury Department of the United States Government offers the following table as suggestive in the expenditure of money in the household. Discuss what you find in the study of the table. Make some original problems from the data.

HOME BUDGETS

Income	$900.00	$1200.00	$1500.00	$1800.00	$2100.00	$2400.00	$3000.00	$5000
Savings	24.00	50.00	100.00	225.00	350.00	470.00	750.00	1250
Food	425.00	480.00	540.00	600.00	600.00	660.00	720.00	840
Clothing	90.00	150.00	200.00	240.00	278.00	300.00	360.00	600
Shelter	2 rooms	3 rooms						
1. Rent	156.00	228.00	240.00	300.00	360.00	....	....	....
2. Investment and Taxes	....	....		....		330.00	330.00	540
3. Heat, Light	68.80	72.00	100.00	100.00	120.00	120.00	120.00	240
Recreation	36.00	48.00	72.00	72.00	84.00	96.00	108.00	240
Church and Charity	18.00	36.00	60.00	72.00	84.00	96.00	108.00	240
Insurance	24.00	72.00	72.00	72.00	84.00	96.00	108.00	240
Car Fare	31.20	31.20	31.20	31.20	31.20	31.20	31.20	...
Miscellaneous, including Literature and Physician	27.00	32.80	48.80	51.80	72.80	100.80	156.80	330
Help in Home	....	....	*36.00	*36.00	*36.00	*100.00	208.00	480
Total	$900.00	$1200.00	$1500.00	$1800.00	$2100.00	$2400.00	$3000.00	$5000

* Employed by the hour.

2. In estimating the cost for food, the government regards the food necessary for a man as 1.00; that for a woman or a child over 11 as .90; the child from 7 to 10 as .75; the child from 4 to 6 as .40; and the child of 3 or less as .15. In a family consisting of husband, wife, three girls (5, 7 and 12 years) and two boys (9 and 2½ years) what estimate would the government make?

3. *a.* How much is saved monthly in a family with a $2400 income? In a family with a $1200 income?

b. What part of the $1500 income is allowed for recreation?

c. Which is the most expensive item in the above budget?

d. What part of the $1800 income is spent for this one item? What part of the $3000 income?

53.* *Addition and Subtraction of Denominate Numbers.*

1. *For study.* The sales of ice cream at a confectionary store one day were 8 gal. 3 qt. of vanilla cream and 5 gal. 2 qt. 1 pt. chocolate cream. *a.* Find the total amount of cream sold. *b.* How much more vanilla cream was sold than chocolate?

Write	Think
a. 8 gal. 3 qt. 5 2 1 pt. 14 gal. 1 qt. 1 pt.	3 qt. + 2 qt. = 5 qt. or 1 gal. and 1 qt.

He sold 14 gal. 1 qt. 1 pt. of cream.

	Think
b. 8 gal. 3 qt. 5 2 1 pt. 3 gal. 0 qt. 1 pt.	Think of 3 qt. as 2 qt. and 2 pt. and subtract as with other numbers.

He sold 3 gal. 1 pt. more of vanilla than chocolate.

2.	bu.	pk.	**3.**	yd.	ft.	**4.**	lb.	oz.	**5.**	ft.	in.
	14	2		18	1		43	10		18	6
	8	3		12	2		37	14		8	9

54. *Solve by dividing the denominator:*

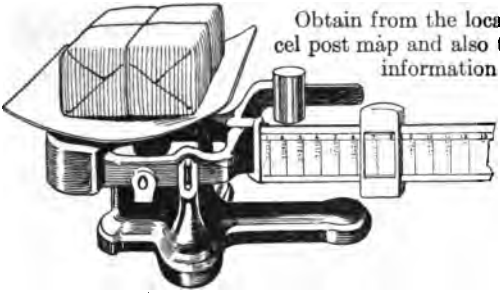
1. $2 \times \frac{5}{6}$	**2.** $3 \times \frac{7}{9}$	**3.** $4 \times \frac{5}{12}$	**4.** $8 \times \frac{3}{16}$
$3 \times \frac{5}{6}$	$4 \times \frac{7}{8}$	$7 \times \frac{3}{14}$	$5 \times \frac{3}{20}$
$2 \times \frac{3}{4}$	$2 \times \frac{5}{10}$	$6 \times \frac{7}{18}$	$6 \times \frac{7}{12}$
$4 \times \frac{5}{8}$	$3 \times \frac{5}{9}$	$5 \times \frac{4}{15}$	$4 \times \frac{5}{24}$

Why is it a better plan in such exercises to divide the denominator rather than to multiply the numerator?

55. *Find the difference:*

1. $4210\frac{3}{8}$ $2796\frac{7}{9}$	**3.** $5032\frac{2}{7}$ $3968\frac{5}{8}$	**5.** $9602\frac{5}{8}$ $7896\frac{5}{7}$	**7.** $7604\frac{3}{8}$ $4987\frac{2}{3}$
2. $3124\frac{1}{6}$ $2987\frac{4}{5}$	**4.** $7214\frac{3}{5}$ $5987\frac{6}{7}$	**6.** $8210\frac{2}{9}$ $6897\frac{4}{7}$	**8.** $3925\frac{4}{9}$ $1578\frac{7}{8}$

56. *Parcel Post — Oral.*



Obtain from the local postmaster a parcel post map and also the book containing information concerning the size, weight limit and description of articles which will be accepted.

Scale Arm **Sliding Weight**

1	2	3	4	5	6	7	8	9	10	11	12	13	Pounds
05	06	06	07	07	08	08	09	09	10	10	11	11	Local
[illegible]	06	07	08	09	10	11	12	13	14	15	16	17	1st Zone
05	06	07	08	09	10	11	12	13	14	15	16	17	2nd "
06	08	10	12	14	16	18	20	22	24	26	28	30	3rd "
07	11	15	19	23	27	31	35	39	43	47	51	55	4th "
08	14	20	26	32	38	44	50	56	62	68	74	80	5th "
09	17	25	33	41	49	57	65	73	81	89	97	1.05	6th "
11	21	31	41	51	61	71	81	91	1.01	1.11	1.21	1.31	7th "
12	24	36	48	60	72	84	96	108	1.20	1.32	1.44	1.56	8th "

By means of the computing scale and the parcel post map find the cost of sending:

1. A 7-pound parcel from your post office to Chicago.

2. An 11-pound parcel from your post office to New York.

3. A 9-pound parcel from your post office to Honolulu.

4. A parcel weighing 2 pounds 5 ounces (merchandise) from your post office to San Francisco.

5. A book weighing 6 ounces from New York to Chicago.

6. A 10-pound package from St. Louis to Boston. Calculate the zone by means of the scale of the map and a ruler.

7. A 14-pound parcel from Chicago to Knoxville, Tenn.

8. What are the limitations for parcels in size and weight?

57.* *Division of a Fraction by an Integer — Multiplying the Denominator.*

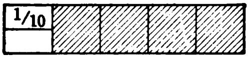
1. *For study.* I paid $\$\frac{1}{5}$ (20¢) for two loaves of bread. How much did I pay for one loaf?

Solution by Integers	Solution by Common Fractions
20¢ ÷ 2 = 10¢	$\$\frac{1}{5} \div 2 = \frac{1}{5 \times 2} = \$\frac{1}{10}$

The bread cost 10¢ or $\$\frac{1}{10}$ a loaf.

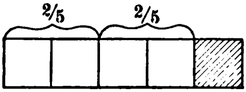
2. With squared paper illustrate any two of the following:

a. *For study.* $\frac{1}{5} \div 2$

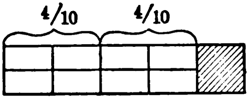


b. $\frac{1}{4} \div 2$
c. $\frac{1}{3} \div 2$
d. $\frac{1}{4} \div 3$

3. *For study.* I paid $\$\frac{4}{5}$ for 2 pounds of coffee. How much was the coffee a pound?



a. $\$\frac{4}{5} \div 2 = \frac{4 \div 2}{5} = \$\frac{2}{5}$



b. $\$\frac{4}{5} \div 2 = \frac{4}{5 \times 2} = \$\frac{4}{10}$

The coffee will cost $\$\frac{2}{5}$ or $\$\frac{4}{10}$ per pound.

4. By diagram illustrate any two of the following:

a. $\frac{6}{8} \div 2$
b. $\frac{6}{9} \div 3$
c. $\frac{8}{12} \div 2$
d. $\frac{7}{12} \div 2$
e. $\frac{10}{12} \div 3$
f. $\frac{8}{10} \div 5$
g. $\frac{9}{12} \div 4$
h. $\frac{11}{12} \div 3$

Complete and learn:

To divide a fraction by an integer (a) —— its numerator or (b) —— its denominator by the integer.

58. *Layman Brothers, Florists — Oral.*

1. Bobbie Hammond came into the store with his grandfather who had given him 75 cents. He spent $\frac{3}{5}$ of his money for a pot of tulips for his mother and the remainder for a pot of crocuses for his sister Alice. How much did he pay for each?

2. Before Easter carnations had sold as low as $1.20 a dozen. At the Easter sale the same quality sold for $1\frac{1}{4}$ of their former price. What was the Easter price?

3. Easter lilies had brought $1.20 before Easter. This was $\frac{2}{3}$ of the price at the Easter sale. What was the Easter sale price?

4. A church committee bought:

6 white lilies	@ $1.50
2 doz. white roses	@ $3.00
5 yd. smilax	@ 20¢

What was the amount of the bill?

5. A Sunday school gave one narcissus bulb to each of its 500 pupils. What was the amount of the bill if the bulbs had been purchased at the rate of $8 per thousand?

6. The customers cared for between 10 A.M. and 2 P.M. were $3\frac{1}{2}$ times the number of customers handled the rest of the day. If during the other hours there were 60 customers, how many customers were in the store during the entire day?

7. On the Monday after Easter, prices again dropped to the normal. Roses which had sold at Easter at $3 a dozen were now priced at $\frac{3}{4}$ of the Easter price. What was the Monday price?

8. Daffodils which sold on Monday at 35¢ a pot were marked at $\frac{7}{10}$ of the Easter price. What had been the Easter price?

9. One of the motor trucks made 60 deliveries on Saturday morning. This was $\frac{2}{5}$ of the deliveries made on Saturday afternoon. How many deliveries were made in all?

59.* *The Hallowe'en Party.*

1. *Dramatize.* The Osborn children gave a Hallowe'en party. Ralph bought apples at 2¢ each, Grace, cider at 9¢ a quart, Martha, oranges at 3¢ each and Fred, jack-o-lanterns at 6¢ each. Each child was given the same amount of money as the others and found that he could spend all of his money for the articles named without having any change left. Mr. Osborn had given each of the children the smallest amount of money which would contain exactly the purchase price of each article bought. How much money did each child receive?

For Study.

$$\begin{aligned} 2¢ &= 2¢ \times 1 \\ 9¢ &= 3¢ \times 3 \\ 3¢ &= 3¢ \times 1 \\ 6¢ &= 2¢ \times 3 \\ \hline \text{L. C. M.} &= 2¢ \times 3 \times 3 = 18¢ \end{aligned}$$

Each child received 18 cents.

1. When one number will contain more than one other number exactly, it is said to be a *common multiple* of those numbers. For example: 54 and 36 are *common multiples* (products) of 3, 4, 6 and 9. 18 is the *least common multiple* of these numbers.

2. The least common multiple is the product of all the prime factors each taken the greatest number of times it occurs in any one number. In the problem above, 2 occurs only once as a factor in any one number and 3 occurs twice as a factor in the number 9.

2. What is the least number of cucumbers that a man can have in a basket so that they may be counted by 3's, 4's or 5's at a time and have none remaining?

3. What is the length of the shortest piece of silk which may be cut exactly into 6, 8 or 9 in. strips?

4. What is the shortest log that may be sawed exactly into 6, 4 or 9 foot boards?

5. What is the least number of eggs that may be placed in cartons containing 8, 9 or 12 and have none remaining?

6. What is the least sum of money that a boy must take to the store in order that he may be able to buy a whole number of pounds of coffee at either 32¢ or 48¢ a pound? How many pounds of each could he buy?

7. What is the length of the shortest rope that can be cut without a remnant into pieces of equal length either 3 feet, 7 feet or 4 feet long?

8. What is the smallest tract of land that may be divided into farms of 40, 60 and 30 acres each?

9. Name two numbers of which 12 is the greatest common divisor.

10. Name two numbers of which 144 is the least common multiple.

11. Find the least common multiple of:

a. 4, 5, 8, 24.
b. 5, 8, 25, 40.
c. 7, 21, 49, 84.
d. 3, 12, 15, 30.
e. 2, 6, 15, 45.
f. 36, 48, 60, 72.
g. 12, 18, 24, 36.
h. 3, 5, 30, 45.
i. 8, 12, 15, 60.
j. 4, 18, 27, 72.
k. 6, 7, 3, 14, 84.
l. 6, 15, 24, 36.

60.* *Clearing of Fractions. Preliminary to Cancellation.*

1. $2 \times \frac{1}{2} = ?$
2. $3 \times \frac{1}{3} = ?$
3. $4 \times \frac{1}{4} = ?$
4. $3 \times \frac{2}{3} = ?$
5. $4 \times \frac{3}{4} = ?$
6. $? \times \frac{5}{6} = 5$
7. $? \times \frac{7}{8} = 8$
8. $? \times \frac{3}{5} = 5$

Continue.

Complete and learn:

When a fraction is multiplied by an integer equal to its denominator the product is an integer equal to its ——.

61.* *Relative Value of Factors in a Product. Preliminary to Cancellation.*

1. *For study.* $6 \times 4 = 24$.

After multiplying the first factor (6) by 2 and dividing the second factor (4) by 2 we have:

a. $12 \times 2 = 24$

After dividing the first factor (6) by 2 and multiplying the second factor (4) by 2 we have:

b. $3 \times 8 = 24$

2. *For study.* $3 \times 6 = 18$

$(3 \times 3)\ (6 \div 3)$ *a.* $9 \times 2 = 18$
$(3 \times 2)\ (6 \div 2)$ *b.* $6 \times 3 = 18$
$(3 \div 3)\ (6 \times 3)$ *c.* $1 \times 18 = 18$

Complete and learn:

The product remains unchanged when one factor is multiplied and the other —— by the same number.

3. Change the relative value of the factors as above:

a. $6 \times 8 = 48$ *b.* $4 \times 9 = 36$ *c.* $12 \times 6 = 72$

Continue.

62. *Divide in the easier way:*

1. $\frac{2}{3} \div 8$
$\frac{4}{5} \div 6$
$\frac{3}{32} \div 3$
$\frac{5}{16} \div 10$
$\frac{3}{4} \div 4$
$\frac{7}{8} \div 3$
$\frac{8}{9} \div 2$

2. $\frac{2}{3} \div 2$
$\frac{6}{7} \div 3$
$\frac{4}{5} \div 8$
$\frac{8}{9} \div 4$
$\frac{5}{9} \div 5$
$\frac{11}{12} \div 2$
$\frac{3}{5} \div 5$

3. $\frac{4}{7} \div 2$
$\frac{7}{9} \div 3$
$\frac{5}{6} \div 5$
$\frac{2}{3} \div 7$
$\frac{4}{5} \div 7$
$\frac{5}{8} \div 5$
$\frac{4}{11} \div 2$

4. $2\frac{1}{2} \div 5$
$3\frac{1}{3} \div 2$
$4\frac{1}{2} \div 3$
$6\frac{1}{4} \div 5$
$3\frac{1}{4} \div 2$
$2\frac{2}{3} \div 2$
$4\frac{1}{5} \div 3$

63. *At sight:*

1. $\frac{3}{8} \times ? = \frac{3}{4}$
2. $\frac{2}{9} \times ? = \frac{2}{3}$
3. $\frac{5}{12} \times ? = \frac{5}{6}$
4. $\frac{4}{21} \times ? = \frac{4}{7}$
5. $\frac{3}{10} \times ? = \frac{3}{5}$
6. $\frac{11}{12} \times ? = 1\frac{5}{6}$
7. $\frac{11}{18} \times ? = 1\frac{2}{9}$
8. $\frac{13}{14} \times ? = 1\frac{6}{7}$
9. $\frac{14}{15} \times ? = 2\frac{4}{5}$
10. $\frac{15}{16} \times ? = 1\frac{7}{8}$

64. *Written Problems.*

1. An ordinary stock car will hold 120 sheep or $\frac{3}{5}$ as many hogs. How many hogs will it hold?

2. A horse can carry a load of 280 pounds. This is $\frac{5}{8}$ of the weight a camel can carry. How many pounds can a camel carry?

3. At $\$2\frac{1}{4}$ each, how many chairs can be bought for $36?

4. What is the cost of a lot 180 feet deep and $62\frac{1}{2}$ feet wide, at $125 a front foot?

5. What will be the cost of sodding this lot at 22¢ per square yard?

6. A boy sawed a board $14\frac{1}{2}$ feet long into 3 equal pieces to make shelves for a cupboard. How long was each shelf?

7. At $3.75 per rod what will it cost to fence a field $\frac{1}{2}$ of a mile long and $\frac{1}{4}$ of a mile wide?

8. A lawn tennis court 78 feet long and 36 feet wide is to be surrounded by a strip of sod 10 feet wide. What will it cost at $.15 per square yard?

9. Two sons receive, respectively, $\frac{1}{2}$ and $\frac{2}{5}$ of an estate. The difference between the amounts they receive is $210. Find the value of the estate. Diagram.

10. Imagine you buy this day of A. B. Block & Company, 2 barrels of flour at $12; 20 pounds of sugar at 18¢; 4 pounds of coffee at 58¢; 5 pounds of butter at $62\frac{1}{2}$¢; and 2 bushels of potatoes at $2.75. Make out a bill and receipt it.

11. $\frac{3}{4}$ of a farm is cultivated; $\frac{3}{20}$ of it is woodland; what is then left, 2 acres, is pasture. How many acres in the farm? Diagram.

12. The estimated cost of building a school house was $80,000. The actual cost was $\frac{5}{4}$ of the estimated cost. What was the actual cost of building the school house?

13. Find the width of the narrowest walk that can be paved with stones cut uniformly 18 inches long and 15 inches wide, allowing them to be laid without waste either lengthwise or across the walk. Use paper cut to scale for demonstration.

14. Allowing $1\frac{3}{4}$ pounds of meat daily for each of 15 sailors, how much meat must be supplied for a cruise of 30 days?

15. A farm costing $2850 was sold at a gain of $\frac{3}{20}$ of the cost. Find the selling price.

16. Make a bill for the following: $2\frac{3}{8}$ yards of lace at 12¢, $5\frac{1}{4}$ yards of ribbon at 19¢, $6\frac{2}{3}$ yards of embroidery at 48¢, 3 spools of thread at 6¢.

17. If the distance around a carriage wheel is $8\frac{1}{2}$ feet, how many revolutions has it made when the carriage has gone 1 mile, or 5280 feet?

18. A swimming tank is 40 feet long and 18 feet wide. What will it cost to cement the bottom at $2.16 per square yard?

19. Mr. Knox spent $285 in improvements for his farm. This was $\frac{3}{8}$ of the value of the year's income from his farm. What was his income?

20. A kindergarten table 4 feet 3 inches long and 20 inches wide is marked off in square inches. How many square inches are there?

21. A man having raised $214\frac{3}{8}$ bushels of potatoes, sold 125 bushels 3 pecks. What is the remainder worth at $2.40 per bushel?

22. Mr. Delker hired a carpenter to repair his house, agreeing to pay him 75¢ an hour. The man worked $9\frac{1}{2}$ days of 8 hours each. Make a bill for the work.

23. One man sold 5 bu. of potatoes for $10.50. A second man sold 3 bu. at the same rate. How much did the second man receive? Ratio.

24. If $36.53 will buy $6\frac{1}{2}$ yards of cloth, how much will 1 yard cost? $\frac{3}{4}$ of a yard?

25. A man sold $\frac{1}{2}$ and $\frac{1}{3}$ of his farm and had 132 acres left. How many acres had he at first?

26. What will $\frac{3}{4}$ of a yard of velvet cost, if $\frac{4}{5}$ of a yard cost $1.60?

65.* *Relative Value of Factors — Cancellation.*

See previous lessons, pp. 167, 168.

1. *For study.* $8 \times \frac{3}{4} = ?$

$$a.\ \frac{8}{1} \times \frac{3}{4} = \frac{8 \times 3}{4} = \frac{24}{4} \text{ or } 6$$

After dividing the first factor (8) by 4 and multiplying the second factor ($\frac{3}{4}$) by 4, we have:

$$b.\ \frac{\overset{2}{\cancel{8}} \times 3}{\underset{1}{\cancel{4}}} = 2 \times 3 = 6$$

2. *For study.* $\frac{4}{5} \times 10 = ?$

$$(\tfrac{4}{5} \times 5)\quad (10 \div 5) \qquad \frac{4}{5} \times 10 = \frac{4 \times \overset{2}{\cancel{10}}}{\underset{1}{\cancel{5}}} = 8$$

Complete and learn:

It does not change the —— of the product if the same factor is cancelled (taken out) from the numerator of one factor and from the denominator of another. This process is known as *cancellation.*

Make sure that pupils recognize in any integer an equivalent fraction whose denominator is 1. For example in the problems above $8 = \frac{8}{1}$ and $10 = \frac{10}{1}$.

3. $\frac{2}{3} \times 9$
4. $21 \times \frac{4}{7}$
5. $\frac{4}{6} \times 9$
6. $15 \times \frac{2}{3}$
7. $\frac{3}{4} \times 6$
8. $15 \times \frac{3}{5}$
9. $\frac{5}{8} \times 16$
10. $24 \times \frac{5}{6}$
11. $\frac{5}{6} \times 12$
12. $\frac{2}{3} \times 6$
13. $\frac{5}{12} \times 18$
14. $\frac{3}{14} \times 21$

66. *Complete and learn.*

a. $1 \times 16 = 16$
$2 \times 16 = 32$
to
$6 \times 16 = 96$

b. $96 \div 16 = 6$
$80 \div 16 = 5$
to
$16 \div 16 = 1$

c. $96 \div 6 = 16$
$80 \div 5 = 16$
to
$16 \div 1 = 16$

67.* *Multiplication of a Fraction by a Fraction.*

1. *For study.* Mrs. Jameson owned a village lot which contained $\frac{1}{4}$ of an acre of ground. She planted $\frac{1}{2}$ of her lot in flowers and the remainder in vegetables. What part of an acre was in flowers? What part in vegetables?

Solution by Integers	Solution by Fractions
1 A. = 160 sq. rd.	$\frac{1}{2} \times \frac{1}{4}$ A. = $\frac{1}{8}$ acre
$\frac{1}{4}$ A. = 40 sq. rd.	
$\frac{1}{2}$ of 40 sq. rd. = 20 sq. rd.	

Mrs. Jameson had 20 sq. rd. or $\frac{1}{8}$ of an acre planted in flowers.

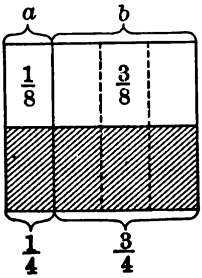
2. *For study.* On a lot containing $\frac{3}{4}$ of an acre which adjoined Mrs. Jameson's lot a boys' clubhouse was built which covered exactly half the second lot. The rest of the lot was a playground. What part of the second lot was in the playground? What part of an acre was in the playground?

Solution by Integers	Solution by Fractions
1 A. = 160 sq. rd.	$\frac{1}{2} \times \frac{3}{4}$ A. = $\frac{3}{8}$ acre
$\frac{3}{4}$ A. = 120 sq. rd.	
$\frac{1}{2}$ of 120 sq. rd. = 60 sq. rd.	

There were 60 sq. rd. or $\frac{3}{8}$ of an acre in the playground.

3. Make diagrams and give solution for:

1. *For study.* *a.* $\frac{1}{2} \times \frac{1}{4}$



2. $\frac{1}{2} \times \frac{2}{3}$
3. $\frac{1}{4} \times \frac{2}{3}$
4. $\frac{1}{5} \times \frac{5}{6}$
5. $\frac{1}{4} \times \frac{3}{8}$
6. $\frac{1}{3} \times \frac{3}{4}$
7. $\frac{1}{6} \times \frac{3}{4}$

68.* *Multiplication of a Fraction by a Fraction — concluded.*

Preliminary Exercise. $1 \times 6 = 6$

If the multiplier (1) is divided by 2, the product (6) is divided by 2.

$(1 \div 2)$	*a.* $\frac{1}{2} \times 6 = 3$	$(6 \div 2)$
$(1 \div 3)$	*b.* $\frac{1}{3} \times 6 = 2$	$(6 \div 3)$
$(2 \times \frac{1}{3})$	*c.* $\frac{2}{3} \times 6 = 4$	(2×2)

Continue.

Complete and learn:

Whatever multiplies or divides the multiplier will also multiply or divide the —— when the multiplicand remains unchanged.

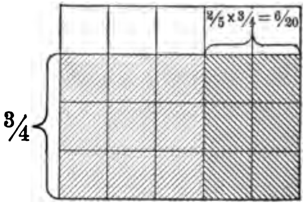
1. *For study.* $\frac{2}{5} \times \frac{2}{3} = ?$

Think: $1 \times \frac{3}{4} = \frac{3}{4}$

$$\frac{1}{5} \times \frac{3}{4} = \frac{3}{5 \times 4} = \frac{3}{20}$$

$$\frac{3}{5} \times \frac{3}{4} = \frac{2 \times 3}{5 \times 4} = \frac{6}{20} \text{ or } \frac{3}{10}$$

Write: $\frac{2}{5} \times \frac{3}{4} = \frac{6}{20}$ or $\frac{3}{10}$



2. Give analysis for:

a. $\frac{4}{7} \times \frac{7}{8}$
b. $\frac{3}{5} \times \frac{5}{7}$
c. $\frac{5}{6} \times \frac{3}{4}$
d. $\frac{3}{4} \times \frac{4}{5}$
e. $\frac{3}{4} \times \frac{5}{9}$
f. $\frac{5}{8} \times \frac{2}{3}$
g. $\frac{2}{3} \times \frac{6}{8}$
h. $\frac{2}{3} \times \frac{3}{4}$
i. $\frac{3}{7} \times \frac{5}{9}$
j. $\frac{5}{7} \times \frac{8}{9}$
k. $\frac{8}{9} \times \frac{7}{8}$
l. $\frac{2}{3} \times \frac{4}{7}$

Do you see a short way to get the answers in the above?

Complete and learn:

To multiply a fraction by a fraction —— the numerators together for a new numerator and multiply the denominators together for a new ——.

69. *Oral Problems.*

1. The inspector of weights and measures found a yardstick one eighth of an inch too long. What is the real distance between two points which is found by this measure to be 24 yards? Actual measurement.

2. Peanuts are selling at 30¢ a lb. What is the cost of 8 ounces?

3. How many collars can be made from $4\frac{1}{2}$ yards of ribbon if one collar requires $\frac{3}{4}$ yard?

4. If you have 56¢ and spend .25 of it for a tablet and $\frac{1}{8}$ for pencils, how much have you left? Change .25 to a common fraction.

5. What will be the gain on a bushel of apples that cost $2.40 and sell for 45¢ a half peck?

6. What will $1\frac{2}{3}$ dozen lemons cost if 2 cost 5¢?

7. A rug is 9 feet long and 6 feet wide. How many square yards of floor will it cover?

8. How many car tickets at 4¢ each can you get for $2?

9. How far will a motorcycle go in $2\frac{1}{4}$ hours if the average rate is 30 miles an hour?

10. A teacher of sewing allows 7 yards of gingham for 3 aprons. How much cloth must she buy for her class of 18 girls?

11. A grocer bought 2 gallons of cream in half-pint bottles. How many bottles did he buy?

12. A square rod is $5\frac{1}{2}$ yards long and $5\frac{1}{2}$ yards wide. How many square yards are there in a square rod?

13. In a spelling test of 50 words a pupil misspelled .2 of the words. How many words did he spell correctly?

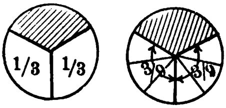
14. A house and lot are valued at $5000. The house is worth .7 of the whole. How much is the lot worth?

15. I sold a cow for $140, which was $\frac{7}{8}$ of the cost. How much did I pay for her?

70.* *Reduction of Fractions to Higher Terms.*

1. *For study.* $\frac{2}{3} = \frac{?}{9}$

$$\frac{2 \times 3}{3 \times 3} = \frac{6}{9}$$



Complete and learn:

It does not affect the —— of a fraction to multiply both its terms by the same number.

Make sure that the pupils see that as the number of the parts increases three-fold (2 to 6) the size of the parts decreases to only $\frac{1}{3}$ of the original size (3rds to 9ths).

Note also that in the reduction of fractions to equivalent fractions of higher denominations that the terms are multiplied by the equivalent of 1.

2. Show by drawing that:

a. $\frac{3}{4} = \frac{6}{8}$ *b.* $\frac{3}{5} = \frac{6}{10}$ *c.* $\frac{5}{6} = \frac{10}{12}$

71.* *Cancellation — concluded.*

See previous lessons, pp. 167, 168, 171.

1. *For study.*

a. $\frac{8}{9} \times \frac{5}{12} = ?$

After cancelling the common factor (4) from 8 and 12, we have

$$\frac{\overset{2}{\cancel{8}}}{9} \times \frac{5}{\underset{3}{\cancel{12}}} = \frac{10}{27}$$

b. $1\frac{2}{3} \times \frac{7}{9} \times \frac{9}{20} = ?$

$$\frac{\overset{1}{\cancel{5}}}{3} \times \frac{7}{\underset{1}{\cancel{9}}} \times \frac{\overset{1}{\cancel{9}}}{\underset{4}{\cancel{20}}} = \frac{7}{12}$$

2. $\frac{6}{9} \times \frac{5}{6} \times \frac{3}{4} = ?$

3. $\frac{5}{7} \times \frac{2}{6} \times \frac{21}{25} = ?$

4. $\frac{2}{19} \times \frac{3}{4} \times 4\frac{2}{9} = ?$

5. $2\frac{1}{9} \times \frac{3}{38} \times 4\frac{2}{3} = ?$

6. $\frac{1}{3} \times \frac{5}{9} \times \frac{3}{15} = ?$

7. $\frac{7}{9} \times \frac{3}{5} \times 2\frac{1}{7} = ?$

8. $3\frac{1}{4} \times 2\frac{3}{7} \times \frac{5}{9} = ?$

9. $\frac{6}{16} \times 2\frac{1}{3} \times 1\frac{1}{7} = ?$

72. *Meadowbrook Farm: XII — The Truck Garden—Written.*

1. The house and garden together occupied 2 acres of ground. The truck garden occupied $\frac{3}{4}$ of this space. How many square rods in the truck garden?

2. Mr. Henderson planted white potatoes in a plot of ground 8 rods wide by 10 rods long. How many rows 8 rods long did he plant, if the rows were 1 yard apart, allowing $1\frac{1}{2}$ feet on each edge? Diagram.

3. If he planted $7\frac{1}{2}$ pounds of seed potatoes in each row, what was the total weight of all the seed potatoes planted?

4. Mr. Henderson realized 20 barrels of potatoes from his planting. He kept .1 of these for home use and sold the rest of the crop for $4.50 a barrel. How much did he receive for the potatoes he sold?

5. Mr. Henderson devoted $\frac{1}{8}$ of an acre to the growing of tomatoes. The plot of ground was 2 rods wide. Length?

6. The tomato plants were planted 3 feet apart and ran the long way of the plot. How many rows were there? Allow 1 foot on each edge.

7. The first tomatoes which had been planted May 18th were ready for the market on the 18th day of July. How many days had elapsed from the time the plants were set out till the crop ripened?

8. Mr. Henderson sold $\frac{4}{5}$ of a ton of tomatoes to a canning factory at the rate of $2\frac{1}{4}$¢ a pound. How much did his tomatoes bring him?

9. Mrs. Henderson put $3\frac{1}{2}$ gallons of tomato catsup into half-pint bottles. How many bottles did she use?

10. Mr. Henderson employed a gardener who worked from March 15 to July 3 inclusive. How many days did he work? (16 Sundays.)

11. The remaining portion of the garden was devoted to vegetables, which were used for the table, and to small fruits. What space did they occupy?

73.* *The Least Common Denominator, or Multiple.*

See previous lessons, pp. 166, 167.

1. *For study.* Roger practiced $\frac{3}{4}$ of an hour on his violin in the morning and $\frac{1}{3}$ of an hour in the afternoon. How long did he practice during the day?

Write		Think
$\frac{3}{4}$	9	$\frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$
$\frac{1}{3}$	4	$\frac{1}{3} \times \frac{4}{4} = \frac{4}{12}$
$1\frac{1}{12}$	$\frac{13}{12} = 1\frac{1}{12}$	

The L. C. D. of two or more fractions is the same as the L. C. M. of their denominators, providing the fractions are in their lowest terms.

Roger practiced $1\frac{1}{12}$ hours during the day.

2. A room is $6\frac{5}{6}$ yards long and $4\frac{5}{9}$ yards wide. How much greater is the length than the width?

3. Arthur lives $1\frac{3}{10}$ miles from school. Louis lives $\frac{7}{8}$ of a mile. How much farther does Arthur live than Louis?

4. *Find the sum:*

a. $\frac{15}{24}$ and $\frac{18}{36}$. *b.* $\frac{7}{18}$ and $\frac{15}{45}$. *c.* $\frac{9}{25}$ and $\frac{11}{35}$.

74.* *Multiplication of a Mixed Number by a Mixed Number.*

See previous lessons, pp. 172, 173.

1. *For study.* What is the cost of $1\frac{1}{3}$ yards of velvet at $\$2\frac{1}{4}$ a yard?

Solution

$1\frac{1}{3}$ yards = $\frac{4}{3}$ yards

$\$2\frac{1}{4} = \$\frac{9}{4}$

$$\frac{\overset{1}{\cancel{4}}}{\underset{1}{\cancel{3}}} \times \frac{\overset{3}{\cancel{\$9}}}{\underset{1}{\cancel{4}}} = \$3$$

$1\frac{1}{3}$ yards of velvet will cost \$3.

2. A furnace burns $3\frac{1}{2}$ tons of coal in a week. At the same rate how many tons will it burn in $2\frac{6}{7}$ weeks?

3. $2\frac{2}{3} \times 1\frac{1}{2} = ?$

4. $7\frac{1}{2} \times 2\frac{2}{5} = ?$

5. $3\frac{1}{5} \times 3\frac{1}{8} = ?$

6. $4\frac{2}{5} \times 1\frac{7}{8} = ?$

7. $4\frac{2}{3} \times 2\frac{4}{7} = ?$

8. $3\frac{3}{5} \times 1\frac{6}{9} = ?$

75. *Meadowbrook Farm: XIII — The Grape Arbor — Oral.*

1. When the Hendersons moved to the farm, they found two old grape vines clambering up the back porch. Their green leaves covered approximately a surface of 140 square feet. The porch was 20 feet long. How high did the vines grow from the ground?

2. Because the vines bore no fruit, Mr. Henderson pruned them back the next fall until no branch was longer than 2 feet. What part of each branch of the following lengths was thrown away:

a. 4 feet
5 feet

b. 6 feet
8 feet

c. 10 feet
12 feet

Give answers in decimals as well as common fractions.

3. Mr. Henderson then built a grape arbor 8 feet wide which extended 50 feet from the back door. He purchased heavy posts which he placed 5 feet apart. How many posts did he purchase? Make drawing on blackboard.

4. The arbor was 8 feet high when finished. If .2 of each post was put into the ground, what was the entire length of each post?

5. He planted 4 vines at the corners of the new arbor and other vines between, at intervals of 10 feet. How many plants did he use?

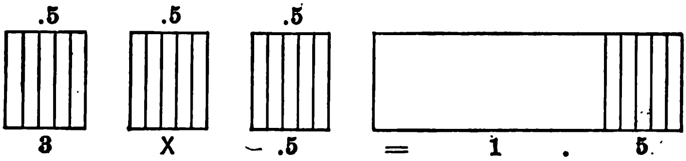
6. If 9 of these plants were Concord grapes and the rest Catawba, what fractional part of the arbor was devoted to each variety?

76.* *Multiplication of a Decimal by an Integer.*

1. *For study.* Alberta practiced on the piano .5 of an hour three times a day. How long did she practice each day?

Solution by Common Fractions	Solution by Decimals	
	Write	Think
$3 \times \frac{1}{2}$ hr. = $\frac{3}{2}$ hr. = $1\frac{1}{2}$ hr.	.5 hr. 3 1.5 hr.	3 times .5 hr. = 15 tenths hr. or 1.5 hr.

Altogether Alberta practiced 1.5 hours ($1\frac{1}{2}$ hr.) each day.



2. Find the cost of 5 dozen oranges at $.36 a dozen.

3. A farmer had 14 sheep from which the average clip per sheep was 9.75 pounds. Find the total yield of wool.

> *Complete and learn:*
>
> When a decimal is multiplied by an integer the product (as in integers) is always of the same denomination as the ——.

77. *Add:*

1.	2.	3.	4.	5.	6.
987	468	189	694	859	979
789	954	997	878	447	863
298	967	868	725	699	268
787	744	373	496	677	477
576	798	137	879	966	625
795	994	965	398	958	566
448	378	239	678	586	955
979	899	868	937	965	893
187	226	337	788	866	389
498	598	978	893	497	899

78. *Written Problems.*

1. Five cans of olive oil were measured very carefully. The first contained $3\frac{1}{8}$ quarts, the second $2\frac{3}{4}$ quarts, the third $3\frac{5}{16}$ quarts, the fourth $1\frac{3}{4}$ quarts and the fifth $2\frac{3}{8}$ quarts. How many gallons of oil were there in all?

2. If it takes a train $\frac{5}{6}$ of an hour to reach a certain station, what fraction of an hour will it take to cover $\frac{3}{8}$ of the distance?

3. If you have the difference between two numbers and the smaller of the two numbers given, how do you find the other number?

4. A carpenter saws a length of 6 feet 11 inches from a board which is 9 feet 2 inches long. How long is the remaining piece?

5. From a barrel of vinegar containing 31.5 gallons there were drawn off 14.75 gallons. How much vinegar was left?

6. If 13 fishing reels cost $\$7\frac{4}{5}$, how much will one cost?

7. Make out a bill for the following, inserting the names of purchaser and dealer and receipting the bill:

3 baskets of figs @ 90¢, 5 doz. cakes of soap @ \$1.08 a doz., $1\frac{1}{2}$ pounds of pork tenderloin @ 55¢, $2\frac{1}{2}$ pounds lamb chops @ 40¢.

8. A certain recipe calls for $\frac{3}{4}$ lb. of sugar. To make $2\frac{1}{2}$ times the recipe, how many ounces of sugar must we use?

9. A milliner used $\frac{8}{9}$ of a yard of velvet for the upper part of a hat and $\frac{5}{8}$ as much for the lower brim. How much velvet did she use for the hat?

10. A man sold 180 head of cattle. This was $\frac{2}{5}$ of all he owned. How many head of cattle did he own?

11. A plate of glass $22\frac{3}{4}$ inches by $36\frac{3}{8}$ inches was set in a picture frame that covered it $1\frac{1}{4}$ inches from each edge. What are the dimensions of the glass not covered by the frame?

12. How many books each $1\frac{1}{4}$ inches thick will it take to make a pile $8\frac{3}{4}$ inches high?

13. If you have the product of two numbers and one of the numbers given, how do you find the other number?

14. Write all the composite numbers under 100, together with their prime factors.

15. I have a room 21 feet wide. How many strips of carpet $\frac{3}{4}$ of a yard wide will be needed to cover the floor?

16. How far will a traveling man go who averages $36\frac{1}{2}$ miles a day for 6 days?

17. If Albert gathered 21 quarts of walnuts and Frank $\frac{2}{3}$ as many, how many quarts did they both gather?

18. Mr. Bronson owns 424 acres of land. He sells $\frac{5}{8}$ of it. How many acres has he left?

19. If the product of two numbers is 5 and one of the numbers is $3\frac{1}{8}$, what is the other?

20. A canning factory ships 30,000 cans of tomatoes in boxes containing 5 dozen cans each. How many boxes does it require?

21. How many floor mats, each $1\frac{3}{4}$ yards long, can be made from a strip of carpet 7 yards long? Make no allowance for hemming.

22. If you know the quotient, the remainder, and the divisor, how do you find the dividend?

23. Mary is $4\frac{5}{8}$ feet tall. Her height is $1\frac{1}{4}$ feet less than her mother's height. How tall is her mother?

24. A grocery boy delivers a basket in which are $3\frac{1}{2}$ pounds of meat, $5\frac{1}{4}$ pounds of sugar, $3\frac{1}{2}$ pounds of butter. The basket weighs $1\frac{1}{8}$ pounds. What is the weight of all?

25. Six pounds of sugar were used for making cakes, each of which required $\frac{3}{4}$ of a pound of sugar. How many cakes were there?

26. In a gentleman's library are 129 books of travel. These are $\frac{3}{10}$ of all his books. How many books are in his library?

79.* *Multiplication of an Integer or a Decimal by* 10 *or a Power of* 10.

Preliminary Exercise.

a. 10 × 50 = ?	100 × 70 = ?

Multiplying tens by 10 gives hundreds; by 100 gives ——.

b. 10 × 5 = ?	100 × 4 = ?

Multiplying units by 10 gives ——; by 100 gives ——.

c. 10 × .5 = ?	100 × .7 = ?

Multiplying tenths by 10 gives units; by 100 gives tens.

d. 10 × .05 = ?	100 × .06 = ?

Multiplying hundredths by 10 gives ——; by 100 gives ——.

e. 10 × .005 = ?	100 × .009 = ?

Multiplying thousandths by 10 gives ——; by 100 gives ——.

Continue.

1. *For study.* The English pound (a piece of money) is worth about $4.867 in our money. How much are 10 English pounds worth in our money?

Think:		Write:
$4.867	10 × $ .007 = $ .07	10 × $4.867 = $48.67
10	10 × .06 = .60	
$48.670	10 × .80 = 8.00	
	10 × 4.00 = 40.00	
	$48.67	

Ten English pounds are worth $48.67 in our money.

2. 10 × 4.63 = ?	**3.** 10 × 63.765 = ?
100 × 4.63 = ?	100 × 63.765 = ?
1000 × 4.63 = ?	1000 × 63.765 = ?

Complete and learn:

The short way to multiply an integer or a decimal by 10 or a power of 10 is to move the decimal point in the multiplicand as many places toward the —— as there are ciphers in the multiplier. The powers of 10 are 100, 1000, etc.

80. *Oral Exercises.*

1. A man who owned $\frac{4}{5}$ of a mill sold $\frac{1}{4}$ of his share. What part of the mill did he still own? What decimal part of the mill did he sell?

2. How many times is $\frac{7}{8}$ contained in $7\frac{7}{8}$?

3. How many quarts are there in 3 bushels and 1 peck?

4. If $\frac{2}{5}$ of a yard of lace cost $4, what will $2\frac{2}{5}$ yards cost? Two ways.

5. Mr. Lawrence sent 67 books to be bound. The binder made mistakes in lettering 19 of them. How many were lettered correctly?

6. 36 is $\frac{9}{7}$ of what number?

7. How much cloth at $$1\frac{1}{4}$ a yard can be bought for $5?

8. During the berry season last year, which lasted 2 weeks, James picked 16 quarts of berries and sold them at 80¢ a gallon. How much money did he earn?

9. If a train starts at 16 minutes past 2 o'clock and reaches its destination at 28 minutes past 4 o'clock, how long is it on the way?

10. How many cakes of soap 2 inches wide and 3 inches long can you lay on the bottom of a box 1 foot square?

11. How many times is $\frac{3}{4}$ contained in $6\frac{3}{4}$?

12. Mr. Beck bought 2 bushels of grass seed for $6 a bushel. He paid 50¢ for paper bags into which to put the seed and sold it at 20¢ a quart. How much did he make by the operation? Did he make a "reasonable profit"?

13. At the rate of 12 pounds for a dollar, how many pounds of starch can you buy for 25¢? For 75¢?

14. How many strips of ribbon $1\frac{1}{2}$ yards in length can be cut from a piece containing 12 yards?

15. My brother is 8 years older than I. His age is $\frac{5}{4}$ of my age. How old is he?

16. A man bought a horse for $240 and sold him for $300. What fractional part of the cost did he gain? What decimal part?

17. A garden contains 60 sq. ft. If .20 of it is planted in beans and the remainder in corn, how many square feet are planted in corn?

18. What will be the cost of 6 dozen eggs at $62\frac{1}{2}$ cents per dozen?

19. If 2 ounces of flower seed cost 17 cents, what will 1 pound cost?

20. A merchant sold muslin at a loss of 2 cents per yard, thereby losing $\frac{1}{20}$ of the cost. What was the cost?

21. A room 9 feet wide and 12 feet long will require how many yards of picture molding?

22. At the rate of five pounds for a dollar, what will 9 pounds of macaroni cost?

23. I sold a piano for $840. This was $\frac{2}{9}$ less than it had cost. What was its cost?

24. Jane spelled .95 of the lesson correctly and Clarence missed .08 of it. Which had the more nearly perfect lesson?

25. Oranges bought at 2 for 5 cents are sold at 6 for a quarter. How much will a boy make on one dozen oranges?

26. I sold a dwelling for $5000 at a profit of $\frac{1}{4}$. What did it cost me?

27. I bought $3\frac{2}{3}$ yards of cloth at 75¢ per yard. How much change remains from a $10 bill?

28. How many oranges are there in a basket if 16 are bad and .92 are good?

29. I sold a house at an advance of $\frac{3}{7}$ and gained $210. Find the cost of the house.

30. A stationer bought pencils at the rate of 3 for 4 cents, and sold them at the rate of 2 for 3 cents. How much did he gain or lose on 1 dozen pencils?

31. At the rate of 3 for a dime, find the cost of 2 dozen peaches.

32. A boy spent 15 cents for papers. This was $\frac{3}{5}$ of the amount of his selling price. What was his profit?

81.* *Finding the Value of a Decimal Part when that of the Whole is Known.*

1. *For study.* Mr. Lavering owned a farm of 40 acres. He sowed .6 of it in wheat. How many acres were planted in wheat?

Analysis by Common Fractions	Analysis by Decimals
$\frac{10}{10}$ of f. = 40 acres	1.0 of f. = 40 acres.
$\frac{1}{10}$ of f. = 40 A. ÷ 10 = 4 acres	.1 of f. = 40 A. ÷ 10 = 4 acres
$\frac{6}{10}$ of f. = 6 × 4 A. = 24 acres	.6 of f. = 6 × 4 A. = 24 acres

Mr. Lavering planted 24 acres in wheat.

2. In a school are 480 pupils. If .5 of them are girls, how many are girls?

3. A boy had 300 marbles and lost .25 of them. How many marbles did he lose and how many did he have left?

4. A hawk captured .03 of 200 chickens. How many chickens were left?

5. What is: *a.* .6 of 30? *b.* .3 of 90? *c.* .9 of 90? *d.* .8 of 80?

6. What is: *a.* .07 of 5600? *b.* .09 of 8100? *c.* .08 of 3200? *d.* .06 of 2400?

82. *Add:*

1. 469.793 + 78.03 + .786 + 478.963.
2. 98.026 + 168.809 + 42.9 + .04.
3. 964.280 + 2.9 + 16.49 + 987.04.
4. 486.05 + 29.873 + .98 + 568.7.
5. 496.279 + 27.08 + 9.6 + 298.7.

83. *Solve by cancellation.*

1. $2\frac{1}{2} \times \frac{8}{15} \times 1\frac{1}{8} = ?$
2. $1\frac{4}{5} \times 3\frac{1}{3} \times 1\frac{4}{8} = ?$
3. $8\frac{2}{3} \times \frac{5}{13} \times 2\frac{1}{5} = ?$
4. $5\frac{2}{3} \times \frac{15}{34} \times 4\frac{4}{5} = ?$
5. $\frac{7}{12} \times 1\frac{3}{9} \times 1\frac{2}{7} = ?$
6. $1\frac{3}{8} \times \frac{4}{33} \times 1\frac{1}{5} = ?$
7. $7\frac{1}{5} \times 1\frac{1}{9} \times \frac{1}{8} = ?$
8. $6\frac{2}{3} \times 4\frac{1}{5} \times 1\frac{1}{9} = ?$

84.* *Multiplication of an Integer by a Decimal.*

Preliminary Exercise.

1. $5 \times 8 = 40$

If we divide the multiplier (5) by 10, it will divide the product (40) by 10. See principle stated on page 173.

(5 ÷ 10) *b.* $.5 \times 8 = 4.0$ (40 ÷ 10)
(5 ÷ 100) *c.* $.05 \times 8 = .40$ (40 ÷ 100)

Solve by common fractions and by decimals.

2. *For study.* It took the Bridgeport car $\frac{1}{2}$ hour to make the round trip. How long was it in making 2.5 trips?

Solution by Common Fractions

$\frac{5}{2} \times \frac{1}{2}$ hr. = $\frac{5}{4}$ hr. or $1\frac{1}{4}$ hr.

Solution by Decimals

$$\begin{array}{r} 30 \text{ min.} \\ \underline{2.5\phantom{\text{ min.}}} \\ 150\phantom{\text{ min.}} \\ \underline{60\phantom{\text{ min.}}} \\ 75.0 \text{ min.} \end{array}$$

The Bridgeport car was $1\frac{1}{4}$ hr. or 75 min. in making 2.5 trips.

3. In a school of 900 pupils, .60 were girls. How many boys in the school?

4. Mr. Matthews bought a home for $6000. He borrowed .25 of the amount. How much of his own money did he pay?

5. A wholesale grocer had 200 gallons of vinegar. Of this quantity, .80 was cider vinegar and the rest tarragon vinegar. How many gallons of tarragon had he?

6. In an orchard of 400 trees, .05 were plum. How many plum trees were there?

7. *a.* $25 \times 8 = ?$
b. $2.5 \times 8 = ?$
c. $.25 \times 8 = ?$
d. $.025 \times 8 = ?$

8. *a.* $3.4 \times 6 = ?$
b. $34 \times 6 = ?$
c. $.34 \times 6 = ?$
d. $.034 \times 6 = ?$

9. *a.* $.047 \times 5 = ?$
b. $.470 \times 5 = ?$
c. $4.70 \times 5 = ?$
d. $470 \times 5 = ?$

85.* *Multiplication of a Decimal by a Decimal.*

1. *For study.* At \$.80 a pound what will I pay for .5 of a pound of tea?

Solution by Common Fractions	Solution by Decimals
$\$.80 = \$\frac{4}{5}$	.80
$.5 = \frac{1}{2}$ lb.	.5
$\frac{1}{\underset{1}{\cancel{2}}} \times \frac{\overset{2}{\cancel{\$4}}}{5} = \$\frac{2}{5}$	$\$.40\cancel{0}$

.5 of a pound of tea will cost \$.40 or $\$\frac{2}{5}$.

2. *For study.* How much will .25 of a bushel of potatoes cost at \$2.40 a bushel?

Solution by Common Fractions	Solution by Decimals
$\$2.40 = \$2\frac{2}{5}$	\$2.40
$.25 = \frac{1}{4}$ bu.	.25
	1200
	480
$\frac{1}{\cancel{4}} \times \frac{\overset{3}{\cancel{\$12}}}{5} = \$\frac{3}{5}$	$\$.60\cancel{0}\cancel{0}$

.25 of a bushel of potatoes will cost \$.60 or $\$\frac{3}{5}$

> *Complete and learn:*
>
> In the multiplication of a decimal by a decimal, multiply as if the numbers were integers and from the right of the product point off as many decimal places as there are decimal places in both the —— and the ——.

3. 2 × .3
2 × .03
.2 × .3

4. 5 × 1.5
.5 × 15
.05 × 15

5. .06 × 25
.6 × 2.5
6 × .025

86. *Solve by Cancellation:*

1. $2\frac{1}{2} \times$ [illegible] $\times 9\frac{1}{3} = ?$

2. $5\frac{4}{7} \times \frac{6}{13} \times 4\frac{3}{8} = ?$

4 — 7
5
1 1 1

87. *Subtract:*

1. $\begin{array}{r} 962\frac{5}{24} \\ \underline{298\frac{13}{18}} \end{array}$
2. $\begin{array}{r} 872\frac{13}{36} \\ \underline{698\frac{29}{54}} \end{array}$
3. $\begin{array}{r} 409\frac{4}{15} \\ \underline{289\frac{23}{25}} \end{array}$
4. $\begin{array}{r} 567\frac{7}{18} \\ \underline{324\frac{11}{12}} \end{array}$
5. $\begin{array}{r} 664\frac{5}{21} \\ \underline{599\frac{23}{49}} \end{array}$
6. $\begin{array}{r} 731\frac{5}{14} \\ \underline{497\frac{19}{21}} \end{array}$
7. $\begin{array}{r} 287\frac{7}{32} \\ \underline{165\frac{37}{56}} \end{array}$
8. $\begin{array}{r} 923\frac{5}{42} \\ \underline{486\frac{13}{30}} \end{array}$

88. *Find quotient:*

1. 166,188,486 ÷ 196
2. 313,458,598 ÷ 387
3. 348,635,816 ÷ 387
4. 255,951,495 ÷ 296
5. 321,484,301 ÷ 293
6. 265,504,863 ÷ 269

89. *Written Dictation.*

1. What is .6 of 56?

2. $\frac{3}{4} + \frac{7}{8} = ?$

3. At a zoölogical garden the animals eat 300 pounds of beef per day. What is the cost at $24 per hundred pounds?

4. A baby elephant weighs 400 pounds. His weight is $\frac{2}{5}$ as much as his mother's weight. How much does the mother elephant weigh?

5. The weekly ration of vegetables is 7 barrels. How long will 91 barrels last them?

90. *Divide in the easier way:*

1. *a.* $11\frac{2}{3} \div 7$ *b.* $11\frac{2}{3} \div 8$
2. *a.* $13\frac{1}{2} \div 3$ *b.* $13\frac{1}{2} \div 4$
3. *a.* $6\frac{6}{7} \div 2$ *b.* $6\frac{6}{7} \div 5$
4. *a.* $9\frac{4}{5} \div 7$ *b.* $9\frac{4}{5} \div 8$
5. *a.* $12\frac{1}{2} \div 3$ *b.* $12\frac{1}{2} \div 5$
6. *a.* $10\frac{5}{6} \div 5$ *b.* $10\frac{5}{6} \div 6$

91. *Find the product:*

1. *For study.*	*a.* 20 × 8.06 = ?	*b.* 40 × 80.7 = ?
	10 × 8.06 = 80.6	10 × 80.7 = ?
	2 × 80.6 = 161.2	4 × 807 = ?
Therefore	20 × 8.06 = 161.2	40 × 80.7 = ?

2. 50 × .382 = ? 3. 500 × 3.82 = ? 4. 5000 × 38.2 = ?

92.* *Multiplication of Denominate Numbers.*

1. *For study.* Each day for a week a family used 2 qt. 1 pt. of milk. How much milk did they use during the week?

Write			Think
	qt.	pt.	
	2	1	7 × 1 pt. = 7 pt. or 3 qt. 1 pt.
		7	7 × 2 qt. = 14 qt.
4 gal.	1 qt.	1 pt.	14 qt. + 3 qt. (carried) = 17 qt. or 4 gal. 1 qt.

The family used 4 gal. 1 qt. 1 pt. of milk that week.

2. If a locomotive consumes an average of 94 lb. 5 oz. of coal per mile, how many tons will it consume on a run of 126 miles?

3. A mail carrier travels on an average 7 miles 6 rods in delivering mail. If he makes 2 deliveries a day, how far does he travel each week?

4. A man wishes to pack 24 barrels with apples. If each barrel contains 2 bushels 2 pecks, how many bushels will be required for all?

5. How much time per week does a girl spend practicing on the piano if she practices 1 hr. 45 min. every day except Sunday?

Solve each of the foregoing problems again, using fractions. For example in Problem 1: 2 qt. 1 pt. = $2\frac{1}{2}$ qt.

Multiply:

6. 5 yr. 7 mo. 9 da. by 7 **7.** 8 sq. yd. 5 sq. ft. by 13

93. *Multiply:*

1. 4.75 by 2.4
2. 9.34 by 8.1
3. 65.80 by .94
4. 27.65 by 4.6
5. 5094 by .4595
6. 3145 by 16.32

94. *Reduce to lowest terms:*

1. $\frac{54}{90}$
2. $\frac{144}{216}$
3. $\frac{56}{98}$
4. $\frac{80}{144}$
5. $\frac{132}{180}$
6. $\frac{105}{126}$
7. $\frac{72}{96}$
8. $\frac{224}{288}$
9. $\frac{32}{112}$
10. $\frac{52}{117}$
11. $\frac{51}{116}$
12. $\frac{115}{253}$
13. $\frac{84}{180}$
14. $\frac{85}{238}$
15. $\frac{117}{121}$
16. $\frac{162}{198}$
17. $\frac{104}{117}$
18. $\frac{153}{221}$
19. $\frac{84}{132}$
20. $\frac{161}{184}$

95. *Written Problems.*

1. Mr. Brown, who owns $\frac{3}{5}$ of a factory, values his share at $21,000. What is the value of the factory?

2. One morning two boys rode on their bicycles from seven o'clock to twelve o'clock. They rode in opposite directions, one boy making an average of $7\frac{2}{3}$ miles an hour and the other $6\frac{1}{2}$ miles an hour. How far apart were they at 12 o'clock?

3. From a piece of land containing 2400 square rods, .18 of the piece was sold. How many acres remained?

4. A man left a farm valued at $12,000 which was to be divided equally among 5 heirs. One heir chose to keep his share of the farm. What was the value of the part to be sold?

5. A man invested $15,200 in his business. This was $\frac{4}{5}$ of his money. How much had he before the investment?

6. A workman who earned $3.50 a day had his wages increased .20. What is his daily wage now?

7. In a city in which $\frac{1}{50}$ of the people are foreigners there are 147,000 native Americans. What is the population of the city?

8. A man paid $4500 for a house and $150 for repairs. He then sold it for .15 above the entire cost. What was the selling price?

9. I lost $200 by selling a house for $\frac{2}{25}$ less than the cost. Find cost and selling price.

10. This year an apartment rented for $660 which is $\frac{1}{10}$ more than it rented for last year. What was the monthly rent last year?

11. A piece of boiling beef weighed 3 lb. before cooking and cost 96¢. After the meat was cooked and the bone removed that which was left weighed $1\frac{3}{4}$ pounds. How much did this edible portion of the meat cost per pound?

12. How many dozen geraniums must I buy to make a border for both sides of a walk 6 yards long, if I place the geraniums 12 inches apart? Drawing.

13. What will it cost to paint the floor of a hall 21 feet long and 6 feet wide, at 40 cents a square yard?

14. Write a fraction whose numerator is six and whose denominator is eight. Write another fraction of the same value but having parts one half as large as the first. Write a third fraction of the same value but having parts twice as large.

15. Three boys have kite strings. Henry's is $19\frac{1}{2}$ rods long, John's is $23\frac{3}{8}$ rods long, and Robert's is $17\frac{5}{6}$ rods long. How long a kite string could be made from all three?

16. At $\$\frac{3}{8}$ a pound, how many pounds of coffee can be bought for $\$3\frac{1}{4}$?

17. Beginning with the smallest, write the following in the order of their size: $\frac{2}{5}$, $\frac{2}{3}$, $\frac{2}{7}$, $\frac{2}{9}$.

18. A mail agent made 48 round trips one year over a railroad 108 miles long. How many miles did he travel?

19. A field is $30\frac{1}{8}$ rods long. This is $5\frac{5}{6}$ rods longer than its width. How wide is it? What is the distance around the field?

20. A carpenter puts up three shelves. One is $7\frac{5}{6}$ feet long, the second $4\frac{1}{4}$ feet and the third $9\frac{1}{12}$ feet long. How many feet of shelving does he use?

21. The following recipe was given to the cooking class and each girl was directed to prepare $\frac{1}{4}$ of the full amount. How much of each ingredient should each take?

Tomato Soup

2 cans tomatoes.
$\frac{1}{2}$ teaspoon soda.
5 teaspoons salt.
1 slice onion.
1 pt. milk.
4 tablespoons flour.
3 tablespoons butter.

22. Find the value of 6 pounds 12 ounces of butter at 60¢ a pound.

23. How many cards 6 inches by 2 inches can be cut from a cardboard 3 feet by 2 feet?

24. A farmer sold 2415 pounds of wheat at $2.15 per bushel (60 lb.); how much did he receive for it?

25. What was the cost of an article that was sold for $850 or at a loss of $\frac{2}{19}$ of the cost?

26. Ten years ago the population of a certain town was 18,000. It has now increased .03 of that number. What is the present population?

27. A man bought 30 cows at $120 a head and sold one half of them at $150 a head. What average price must he receive for the remainder to gain $225 on the transaction?

28. What is the least sum that can be paid either in $2 bills, $5 bills, $10 bills, $20 bills or $50 bills?

29. What part of the day has passed by 10:30 A.M.?

30. Make drawings to inclose 24 square rods of ground in as many rectangular shapes as possible.

31. Find the cost of sending a telegram of 20 words, if the rate is 40 cents for the first 10 words and 3 cents for each word over 10.

32. What date is 60 days after January 15?

33. Write an original problem about a trip on a trolley car which the class can solve without pencil.

34. When milk yields butter fat to the amount of $\frac{1}{25}$ of its weight, how many pounds of milk will yield 12 pounds of butter?

35. How many square feet of zinc are required to line the sides and bottom of a box 5 feet long, 4 feet wide and 3 feet deep?

36. An automobile was sold for $1400, which was a gain of $\frac{2}{5}$ over the cost of production. What was the cost of production?

Test Page I

This page and the one following contain types of exercises which the class should do readily before proceeding to more difficult work. A class percentage of not less than eighty should be required.

These pages can also be used for classes about to take up the work of the second section of Part II.

I

Write answers only:

1. Write in figures: Ten million and ten thousandths.

2. Write in words: 80,042.096.

3. Charles weighs 60.5 pounds and his weight is 3.6 pounds less than William's. How much does William weigh?

4. Paper was torn from a tablet $\frac{7}{8}$ of an inch thick, until it was only $\frac{1}{4}$ of an inch thick. How much paper had been torn off?

5. A farmer sold a horse at a loss of $\frac{1}{20}$ of the cost, thereby losing $15. How much did the horse cost him?

II

Show all work — time limit 25 *minutes:*

1. A woman has found that she must save $600 this year. She has decided to take table boarders, and can accommodate ten. If she pays $4080 for provisions, service and rent, and her rooms are full all the year, how much must she charge per week to save the $600?

2. After spending $\frac{1}{4}$, $\frac{2}{5}$ and $\frac{1}{8}$ of his money, a man found he had $117 left; how much had he at first?

3. There are 160 acres in 3 fields. The first contains 38.375 acres, the second 67.59 acres. How many acres in the third field?

4. A coal dealer ordered 21,500 tons of coal. Only .85 of this order was received. How many tons did he receive?

Test Page II

III

Oral Problems

Before solving, name the operation to be used in the problem.

1. Four pecks 3 quarts of nuts were divided evenly among some children, each child receiving 5 quarts. How many children were there?

2. The junior partner, who owns $\frac{3}{5}$ of the capital, receives $750 gain. What is the whole gain?

3. A boy who lives 20 squares from school rides .6 of the way on the car. How far does he walk?

4. How many strips of carpet $\frac{2}{3}$ of a yard wide will be needed to cover a floor 18 feet wide?

5. I paid 80 cents for 3 tubes of tooth paste. What would I have to pay for 12?

IV

Write at dictation:

1. Add: $1.988 + 234.0006 + 10.7 + .9876 + 8.875 + 89.67 + 9.889 + 9758 + 2.003 + .1$ (two minutes)

2. Find the difference between: 1.3 and .98756 (two minutes)

3. Multiply 791.004 by 289. (three minutes)

4. Solve by cancellation: $\frac{5}{9} \times 2\frac{7}{10} \times 1\frac{2}{3} = ?$ (two minutes)

5. Divide 47,658,286 by 397. (three minutes)

V

Each child one exercise: (*oral*).

1. $.5$ of $60 = ?$
$1.2 + 3.9 = ?$
$5.6 - 2.5 = ?$
$\frac{2}{3} \div 4 = ?$
$\frac{5}{6} \times \frac{1}{2} = ?$

2. $.9 + 3.1 = ?$
$.4$ of $30 = ?$
$1.2 - .4 = ?$
$\frac{1}{3} \times \frac{1}{2} = ?$
$\frac{4}{5} \div 6 = ?$

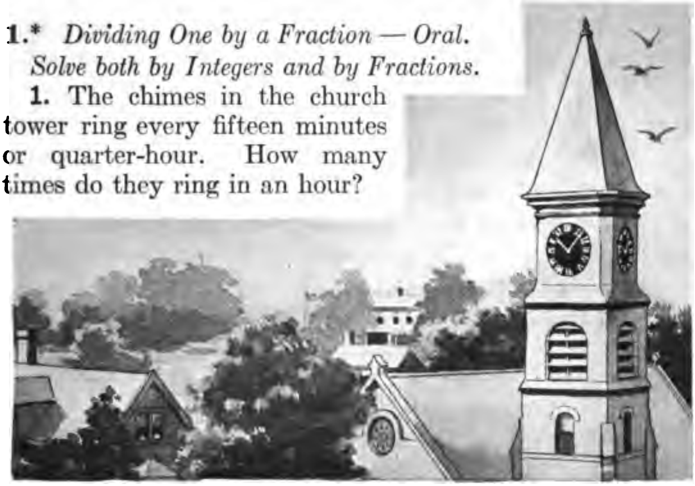
3. $1 - .7 = ?$
$2.1 + 3.6 = ?$
$.6$ of $70 = ?$
$\frac{2}{3} \times \frac{4}{5} = ?$
$\frac{7}{8} \div 5 = ?$

PART II — SECTION TWO

1.* *Dividing One by a Fraction — Oral.*

Solve both by Integers and by Fractions.

1. The chimes in the church tower ring every fifteen minutes or quarter-hour. How many times do they ring in an hour?



Solution by Integers	Solution by Fractions
60 min. ÷ 15 min. = 4 times	1 hr. ÷ $\frac{1}{4}$ hr. = 4 times

The chimes ring 4 times in one hour.

2. A baker used 1 dozen eggs in making cakes. In each cake he used 2 eggs or $\frac{1}{6}$ of a dozen. How many cakes did he make?

3. A club of boys spent $1 on fishing rods. Each boy contributed 20¢ or $$\frac{1}{5}$. How many boys belonged to the club?

4. Find the quotient:

a. $1 \div \frac{1}{3} = ?$ *b.* $1 \div \frac{1}{9} = ?$ *c.* $1 \div \frac{1}{7} = ?$ *d.* $1 \div \frac{1}{5} = ?$

Teacher will please read the Preface and the Table of Contents.

Lessons marked * should be assigned for study previous to the recitation. See Suggestions to Teachers.

2. *Divide:*

1. 1,203,742 by 198
2. 1,210,681 by 139
3. 1,547,209 by 176
4. 2,405,079 by 267
5. 1,173,138 by 147
6. 1,134,180 by 157
7. 1,834,846 by 189
8. 1,061,999 by 139

Make sure that the class thoroughly understands why each figure in the quotient is placed directly above the last right-hand figure used in the dividend. This is preparatory to division of decimals.

3. *Add:*

1.	**2.**	**3.**	**4.**	**5.**
$795\frac{3}{4}$	$697\frac{3}{7}$	$875\frac{5}{7}$	$789\frac{5}{7}$	$876\frac{7}{12}$
$874\frac{5}{9}$	$798\frac{11}{12}$	$796\frac{2}{3}$	$999\frac{3}{4}$	$947\frac{5}{6}$
$689\frac{1}{2}$	$579\frac{1}{2}$	$689\frac{4}{9}$	$878\frac{1}{8}$	$859\frac{2}{3}$
$756\frac{7}{18}$	$875\frac{3}{4}$	$479\frac{5}{21}$	$697\frac{9}{14}$	$487\frac{3}{4}$
$987\frac{2}{3}$	$698\frac{5}{21}$	$587\frac{7}{9}$	$876\frac{1}{2}$	$698\frac{1}{2}$
$859\frac{5}{12}$	$976\frac{2}{3}$	$496\frac{4}{7}$	$969\frac{3}{28}$	$475\frac{5}{36}$

4. *Multiply:*

1. 6.46 by 7.6
2. 5.9 by .75
3. 86.9 by 43.9
4. 9.76 by 7.8
5. 8.62 by 4.9
6. 8.408 by 3.7
7. 5.80 by 53.8
8. .098 by .74
9. 8.046 by 39.7
10. 90.27 by 8.79
11. 29.06 by 2.56
12. 39.04 by .627

5. *Find the difference between:*

1. One million six hundred nine thousand and seventy thousandths; and eighty-seven thousand six and seventy-five ten-thousandths.

2. Three million four hundred seventy-six thousand and seven thousand fifty ten-thousandths; and nine hundred sixty-seven thousand five hundred nine and eight hundred ninety-seven ten-thousandths.

3. Two hundred sixty-seven thousand four hundred seventy-one and one hundred twenty-five hundred-thousandths; and ninety-eight thousand five hundred seventy-six and sixty-nine hundredths.

6.* *Dividing One by a Fraction — continued.*

See previous lesson p. 195.

Preliminary Exercise.

a.	$12 \div 1 = 12$	*b.*	$27 \div 1 = 27$
	$12 \div 2 = 6$		$27 \div 3 = 9$
	$12 \div 4 = 3$		$27 \div 9 = 3$

Continue.

7

> *Complete and learn:*
>
> Multiplying the divisor, —— the quotient by the same number.

7

1. *For study.* At $\$\frac{3}{5}$ (60 cents) per yard, how much silk can be bought for \$1?

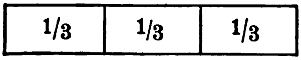
7

Solution by Integers	Solution by Fractions
100¢ ÷ 60¢ = $1\frac{2}{3}$ times	$\$1 \div \$\frac{1}{5} = \frac{5}{1}$ times
	$\$1 \div \$\frac{3}{5} = \frac{5}{3}$ or $1\frac{2}{3}$ times

For \$1 there can be bought $1\frac{2}{3}$ yards.

2. Illustrate with diagrams:

a. For study.



$1 \div \frac{1}{3} = \frac{3}{1}$ times.

$1 \div \frac{2}{3} = 1\frac{1}{2}$ or $\frac{3}{2}$ times.

b.	$1 \div \frac{1}{5}$	*c.*	$1 \div \frac{1}{7}$	*d.*	$1 \div \frac{1}{4}$
	$1 \div \frac{4}{5}$		$1 \div \frac{3}{7}$		$1 \div \frac{3}{4}$

Continue.

> When 1 is divided by a fraction, the result is that the numerator and the denominator change places; that is, the result is written as if the original fraction had been inverted or turned upside down. An inverted fraction is called the *reciprocal* of the fraction: $\frac{4}{3}$ is the reciprocal of $\frac{3}{4}$.

3. If a street car makes a trip in $\frac{3}{4}$ of an hour, how many trips will it make in an hour?

4. Miss Meyers can embroider an initial "B" in $\frac{5}{6}$ of an hour. How much embroidery can she do in one hour?

5. How many pounds of coffee at $\$\frac{2}{5}$ a pound can be bought for $1?

6. Norton walks one mile in $\frac{5}{12}$ of an hour. How many miles can he walk in one hour?

7. *Subtraction from* 100:

Think of 100 − 36 as 90 − 30 and 10 − 6 or 64. It may also be thought of as 100 − 30 − 6; or as 100 − 40 + 4.

1. 100 − 56
2. 100 − 28
3. 100 − 51
4. 100 − 19
5. 100 − 24
6. 100 − 78
7. 100 − 39
8. 100 − 85
9. 100 − 45
10. 100 − 69
11. 100 − 46
12. 100 − 21
13. 100 − 49
14. 100 − 32
15. 100 − 72
16. 100 − 58

17. I owe 27¢. How much change is due me from $1?

18. I buy one article at a store amounting to 35¢ and another amounting to 17¢. How much is due from $1?

19. I owe $1 and pay 83¢ of my debt. How much do I still owe?

20. What change is due from $1 after paying for a purchase of 79¢?

21. My purchases were 18¢ and 15¢. What change did I receive from $1?

8. *At sight:*

1. $5 \times \frac{4}{15}$
2. $4\frac{1}{2} + 1\frac{5}{6}$
3. $\frac{3}{4} \times \frac{8}{9}$
4. $4\frac{1}{2} - 1\frac{5}{6}$
5. $2\frac{2}{3} \div 4$
6. $5\frac{1}{4} \times 2$
7. $1 \div \frac{4}{5}$
8. $6\frac{1}{3} - 4\frac{3}{4}$
9. $\frac{2}{3} \div \frac{1}{6}$
10. $7 \times 1\frac{2}{3}$
11. $4\frac{1}{2} + 7\frac{2}{5}$
12. $\frac{5}{6} \times \frac{18}{25}$
13. $1 \div \frac{7}{8}$
14. $2\frac{3}{4} \times 5$
15. $1 \div \frac{5}{6}$
16. $\frac{4}{5} \times \frac{15}{24}$
17. $3\frac{1}{4} - 2\frac{1}{2}$
18. $2\frac{1}{3} \times 4$
19. $3\frac{1}{5} \div 4$
20. $4\frac{3}{4} + 5\frac{2}{3}$
21. $\frac{5}{6} + \frac{1}{2}$

9. *Written Problems.*

1. Name five tables, a knowledge of which would be necessary in constructing a new post office, and tell for what purpose each will be used. Why must the architect's answers be correct? (The great cellar must be excavated; immense stones lifted into place; walls plastered and frescoed; floors laid; electric lights and bells put in; great furnaces and boilers for heating and ventilating the building will be placed in the basement; and many other interesting things done.)

2. Lawrence Wright owned a small garden farm in Center Township, this county, which he sold for $2200, gaining $\frac{3}{8}$ of its cost. What was the cost price? Diagram.

3. If a plumber receives $1.20 an hour, how much will he receive for 4 hours 15 minutes?

4. A coal merchant having 12,498 tons of coal sold .97 of it during the winter. How many tons were sold?

5. What is the value of a field 60 rods by 80 rods at $75 an acre?

6. If the lumber in each ink-stand made in the manual training classes costs $2\frac{3}{4}$ cents, the stain $\frac{1}{12}$ cent, and the glass well $8\frac{1}{3}$ cents, what will be the total cost of the ink stands made by a class of 36 pupils?

7. Anthracite coal which cost $10 a ton in November, rose .15 of the cost in 1 month. What was the price of coal after the rise in price?

8. How many packages of breakfast food containing $2\frac{1}{2}$ pt. each can be filled from a box holding 5 bushels of breakfast food?

9. A commission merchant having 96 bushels of apples sold $\frac{7}{8}$ of them at $\$3.16\frac{2}{3}$ per bushel. How much did he receive?

10. A dealer sells 672 tons of coal. This is $\frac{7}{8}$ of his entire stock. How much did his entire stock cost him at $3.25 per ton?

11. At 15 cents a quart what will be the cost of 4 bu. 3 pk. of chestnuts?

By daily practice habituate the pupils in estimating results and in checking them.

12. If a clerk's salary is $90 a month and his expenses each month are .65 of this amount, how much does he save in a year?

13. A roadway is 50 ft. wide and 495 ft. long. The grass plot in the center has an average width of 9 ft. and a length of 454 ft. How much of the roadway is used for travel?

14. James Noble repaired and painted a flag pole. The items of expense were as follows: labor, $10; paint, $1\frac{2}{3}$ gal. at $3.50 per gal.; 160 ft. of rope at $\frac{1}{2}$ cent per foot. Make out and receipt bill.

15. Multiply four and five hundredths by three hundred ninety-one thousandths. From the product subtract four hundred three thousandths.

16. After drawing 204 gallons of oil from a tank it was found that $\frac{7}{19}$ of the original quantity remained. How many gallons did the tank contain at first?

17. A father willed one fourth of his property to his eldest son and one fifth to each of his three other sons; the remaining $6000 was given to charities. How much was the whole property worth?

18. At the close of an inventory of dry goods one piece of cloth measured $42\frac{2}{3}$ yards. From this $28\frac{1}{4}$ yards were sold at $\$1\frac{4}{5}$ a yard. Find the number of yards still remaining and the amount received for the part sold.

19. After selling 85.3 acres of land a farmer had 198.38 acres remaining. How many acres had he at first?

20. A man sold property which cost him $9384 at an advance of .05. How much did he gain?

21. In a school containing 675 pupils .08 were absent on Friday. How many pupils were absent?

22. In a mill 2800 operatives earn on an average $2.68 per day. If their wages are increased .10, what will be the increase in the weekly pay-roll?

10. * *Dividing an Integer by a Fraction.*

See previous lessons, pp. 195, 197.

1. *For study.* Janet practiced 5 hours on her music lesson. If she practiced $\frac{5}{6}$ of an hour a day, how many days did she practice?

Analysis by Integers

$5 \text{ hr.} = 300 \text{ min.}$

$\frac{5}{6} \text{ hr.} = 50 \text{ min.}$

$300 \text{ min.} \div 50 \text{ min.} = 6 \text{ times}$

Analysis by Fractions

$$1 \text{ hr.} \div \frac{5}{6} \text{ hr.} = \frac{6}{5} \text{ times}$$

$$5 \text{ hr.} \div \frac{5}{6} \text{ hr.} = \frac{\overset{1}{\cancel{5}} \times 6}{\underset{1}{\cancel{5}}} = 6 \text{ times}$$

$$\text{Write: } 5 \text{ hr.} \div \frac{5}{6} \text{ hr.} = \frac{\overset{1}{\cancel{5}} \times 6}{\underset{1}{\cancel{5}}} = 6 \text{ times.}$$

Janet practiced 6 days on the music lesson.

2. *For study.* $9 \div \frac{3}{8} = ?$

$$1 \div \frac{3}{8} = \frac{8}{3}$$

$$9 \div \frac{3}{8} = \frac{\overset{3}{\cancel{9}} \times 8}{\cancel{3}} = 24$$

3. It is $\frac{3}{4}$ of a mile around the pony track. Jack rode 3 miles. How many times did he go around the track?

4. A coal dealer had 4 tons of coal. He put the coal into bags for delivery, each of which weighed $\frac{1}{20}$ of a ton when filled. How many bags did he use?

7. A confectioner uses paper $1\frac{1}{2}$ ft. long to wrap his boxes. How many wrappers can he get from a roll containing 600 feet?

8. One cake cost $\$\frac{3}{5}$. How many such cakes can be bought for \$3?

9. A boy earns $\$\frac{4}{5}$ a day. How long will it take him to earn \$10?

11. *Written Dictation.*

1. $2\frac{1}{2} \times \frac{1}{4} = ?$

2. What is the difference between 5.2 and 4.9?

3. An automobile traveled 7 hours at the average rate of 20.5 miles an hour. How far did it go?

4. A farm was sold for \$15,000. This was a gain of $\frac{1}{4}$ of the cost. What was the cost?

5. John walks at the rate of $\frac{1}{2}$ mile in 10 minutes. How far does he walk in one hour?

12. *Find the quotient at sight:*

1. $7 \div \frac{5}{6}$
2. $8 \div \frac{4}{5}$
3. $9 \div \frac{7}{8}$
4. $6 \div \frac{3}{7}$
5. $5 \div \frac{5}{8}$
6. $4 \div \frac{5}{7}$
7. $9 \div \frac{3}{7}$
8. $6 \div \frac{7}{8}$
9. $11 \div \frac{3}{5}$
10. $13 \div \frac{4}{7}$
11. $12 \div \frac{5}{9}$
12. $6 \div \frac{2}{5}$
13. $5 \div \frac{8}{9}$
14. $6 \div \frac{5}{11}$
15. $7 \div \frac{4}{9}$
16. $8 \div \frac{5}{6}$
17. $9 \div \frac{3}{13}$
18. $4 \div \frac{7}{9}$
19. $2 \div \frac{4}{9}$
20. $5 \div \frac{7}{15}$
21. $4 \div \frac{7}{8}$
22. $13 \div \frac{5}{8}$
23. $17 \div \frac{2}{3}$
24. $15 \div \frac{3}{8}$

13. *Find the product:*

1. $63\frac{4}{5} \times 865$
2. $35\frac{7}{8} \times 976$
3. $56\frac{4}{5} \times 895$
4. $35\frac{5}{6} \times 300$
5. $24\frac{2}{3} \times 726$
6. $49\frac{2}{9} \times 648$
7. $87\frac{2}{5} \times 620$
8. $59\frac{7}{8} \times 856$
9. $53\frac{5}{6} \times 780$
10. $45\frac{3}{8} \times 848$
11. $36\frac{4}{5} \times 680$
12. $63\frac{4}{7} \times 385$
13. $27\frac{3}{4} \times 876$
14. $53\frac{7}{8} \times 784$
15. $83\frac{5}{7} \times 924$
16. $26\frac{4}{5} \times 840$
17. $37\frac{5}{8} \times 608$
18. $92\frac{5}{9} \times 756$

14.* *Division of a Fraction by a Fraction.*

Preliminary Exercise.

24 ÷ 3 = 8
($\frac{3}{4}$ of 24) 18 ÷ 3 = 6 ($\frac{3}{4}$ of 8)
($\frac{1}{2}$ of 24) 12 ÷ 3 = 4 ($\frac{1}{2}$ of 8)
($\frac{1}{4}$ of 24) 6 ÷ 3 = 2 ($\frac{1}{4}$ of 8) Continue.

> *Complete and learn:*
>
> Taking a fractional part of the dividend will give the same fractional part of the ——.

1. *For study.* At $\$\frac{3}{20}$ each, how many handkerchiefs can be bought for $\$\frac{3}{4}$?

Analysis by Integers

$\$\frac{3}{20} = 15¢$
$\$\frac{3}{4} = 75¢$
75 ÷ 15¢ = 5 times

Analysis by Fractions

$\$1 \div \$\frac{3}{20} = \frac{20}{3}$ times

$$\$\frac{3}{4} \div \$\frac{3}{20} = \frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{4}}} \times \frac{\overset{5}{\cancel{20}}}{\underset{1}{\cancel{3}}} = 5 \text{ times}$$

Write $\$\frac{3}{4} \div \$\frac{3}{20} = \frac{\overset{1}{\cancel{3}}}{\underset{1}{\cancel{4}}} \times \frac{\overset{5}{\cancel{20}}}{\underset{1}{\cancel{3}}} = 5$ times

Five handkerchiefs can be bought for $\$\frac{3}{4}$.

2. $1 \div \frac{2}{3}$
$\frac{1}{2} \div \frac{2}{3}$

3. $1 \div \frac{4}{5}$
$\frac{3}{4} \div \frac{4}{5}$

4. $1 \div \frac{5}{6}$
$\frac{7}{8} \div \frac{5}{6}$

5. If a baker uses $\frac{3}{8}$ of a pound of butter in making one cake, how many such cakes can he make from $1\frac{7}{8}$ pounds?

Children will never become confused as to which of the fundamental processes to use in problems of this type if they keep in mind the analogy between integers and fractions. Teach them to help themselves in cases of difficulty by making an integer problem from the numerators of the fractions involved. For example: If a baker uses 3 pounds of butter in making one cake, how many such cakes can be made from 15 pounds?

15. *Oral Problems.*

1. In what two ways may $\frac{6}{7}$ be divided by 3? How do the results compare in value? Which method gives the quotient in its lowest terms without a reduction?

2. Three fourths of the weight of potatoes is water. The water in a bushel of potatoes will weigh 45 pounds. What is the weight of a bushel of potatoes?

3. A box is $\frac{2}{3}$ as wide as it is long and $\frac{1}{2}$ as deep as it is wide. It is 6 feet long. How deep is it?

4. If a piece of work requires $2\frac{1}{2}$ weeks and another requires twice as long, how many days does the second require, allowing 6 working days to the week?

5. A gardener has .75 of an acre of land, .2 of which he devotes to lettuce. What part of an acre is devoted to lettuce? What part of an acre has he left?

6. If this same gardener should devote .2 of an acre to lettuce, what part of his land does he give to it?

7. I have $4.04 and spend $.89. How much is left?

8. Express $\frac{3}{8}$ of 24 quarts as gallons and quarts.

9. If sound travels 1120 feet a second, how far will it travel in .2 of a second?

10. How many boards each $\frac{5}{8}$ of an inch thick must be placed one on top of another to make a pile 5 inches high?

11. An automobile was sold for $1200. This was at a loss of $\frac{1}{5}$ of the cost. What was the cost?

12. At $\$\frac{7}{8}$ a yard, how much must I pay for $\frac{2}{3}$ of a yard of linen?

13. If the distance between 2 stations is 22.4 miles and the train has gone 6.9 miles from one station toward the other, what is the remaining distance?

14. $\frac{5}{9} \div 3 = ?$ $\frac{6}{11} \div 3 = ?$

16.* *Give quotient:*

See previous lesson, p. 203.

1. *For study.* $\frac{3}{4} \div \frac{2}{3} = ?$

Analysis

$1 \div \frac{1}{3} = \frac{3}{1}$
$1 \div \frac{2}{3} = \frac{3}{2}$
$\frac{3}{4} \div \frac{2}{3} = \frac{3}{4} \times \frac{3}{2} = \frac{9}{8}$ or $1\frac{1}{8}$

Write

$\frac{3}{4} \div \frac{2}{3} = \frac{3}{4} \times \frac{3}{2} = \frac{9}{8}$ or $1\frac{1}{8}$

2. $\frac{5}{6} \div \frac{7}{8}$
3. $\frac{8}{9} \div \frac{2}{3}$
4. $\frac{4}{7} \div \frac{3}{5}$
5. $\frac{3}{4} \div \frac{5}{7}$
6. $\frac{6}{11} \div \frac{5}{8}$
7. $\frac{4}{9} \div \frac{5}{13}$
8. $\frac{2}{9} \div \frac{3}{8}$
9. $\frac{5}{7} \div \frac{4}{11}$
10. $\frac{3}{10} \div \frac{5}{12}$

17. *Find product:*

1. $\frac{3}{7} \times 11$
2. $\frac{5}{8} \times 7$
3. $\frac{3}{4} \times 9$
4. $\frac{7}{10} \times 12$
5. $\frac{5}{6} \times 8$
6. $\frac{2}{3} \times 13$
7. $\frac{4}{5} \times 14$
8. $\frac{6}{8} \times 11$
9. $\frac{7}{9} \times 10$
10. $\frac{4}{5} \times 16$
11. $\frac{6}{7} \times 12$
12. $\frac{5}{9} \times 15$
13. $\frac{4}{7} \times 16$
14. $\frac{5}{8} \times 9$
15. $\frac{7}{10} \times 16$

18. *At sight:*

1. $\frac{6}{9} \div 3$
$\frac{6}{9} \times 3$
$\frac{6}{9} \div 5$
$\frac{6}{9} \times 5$

2. $\frac{10}{15} \div 5$
$\frac{10}{15} \times 5$
$\frac{10}{15} \div 7$
$\frac{10}{15} \times 7$

3. $\frac{4}{8} \div 2$
$\frac{4}{8} \times 2$
$\frac{4}{8} \div 3$
$\frac{4}{8} \times 3$

4. $\frac{12}{18} \div 6$
$\frac{12}{18} \times 6$
$\frac{12}{18} \div 7$
$\frac{12}{18} \times 7$

19. *Give quotient at sight:*

1. 1 ÷ 5
2 ÷ 5
3 ÷ 5
4 ÷ 5
5 ÷ 5
6 ÷ 5
9 ÷ 5

2. 1 ÷ 6
3 ÷ 6
4 ÷ 6
6 ÷ 6
8 ÷ 6
9 ÷ 6
13 ÷ 6

3. 1 ÷ 7
5 ÷ 7
6 ÷ 7
7 ÷ 7
9 ÷ 7
14 ÷ 7
17 ÷ 7

4. 1 ÷ 9
4 ÷ 9
7 ÷ 9
8 ÷ 9
9 ÷ 9
11 ÷ 9
15 ÷ 9

20.* *Square Measure — Plastering and Painting.*

1. ***For study.*** At 50¢ a square yard, what will it cost to lath and plaster the walls of a room 18 feet wide, 24 feet long and 9 feet high?

Use a pasteboard box for demonstration.

Solution

18 ft. + 24 ft. + 18 ft. + 24 ft. = 84 ft. or 28 yd., perimeter of the base of the walls.

28 × 1 sq. yd. = 28 sq. yd., area of a strip one yard wide around the walls.

9 feet = 3 yd. (height of wall).

3 × 28 sq. yd. = 84 sq. yd. (entire area of the four walls).

84 × $.27 = $22.68.

It will cost $22.68 to lath and plaster the walls of the room.

2. What will it cost to plaster the walls of a school room 30 feet long, 18 feet wide and 12 feet high at 50¢ a square yard, deducting $\frac{1}{2}$ of the area of the walls for blackboards, base board and openings?

3. What would it cost the school board to put up a metal ceiling for this same room at 22¢ a square foot?

4. A corridor is 52 feet long, 6 feet wide and 9 feet high. How much will it cost to plaster the side walls and the ceiling at 50¢ a square yard, not allowing for openings?

5. How much should be paid for painting the walls and ceiling of a kitchen 12 feet wide, 15 feet long and 9 feet high at 35¢ a square yard?

21. *Multiply:*

1. 8.75 by .36
2. 97.2 by .089
3. 35.7 by .69
4. .078 by 26.2
5. 85.6 by .095
6. 56.2 by 9.38
7. 57.4 by .278
8. 91.5 by 2.56
9. 7.06 by .895
10. 32.5 by .98
11. 80.6 by 6.35
12. 79.5 by .906

22.* *Division of a Mixed Number by a Fraction.*

See previous lessons, pp. 203, 205.

1. *For study.* How long will $2\frac{1}{2}$ tons of coal last a furnace that burns $\frac{3}{4}$ of a ton in one week?

Solution by Integers	Solution by Common Fractions
$2\frac{1}{2}$ T. = 5000 lb.	$2\frac{1}{2}$ T. = $\frac{5}{2}$ T.
$\frac{3}{4}$ T. = 1500 lb.	$\frac{5}{2}$ T. ÷ $\frac{3}{4}$ T. =
5000 lb. ÷ 1500 lb. = $3\frac{1}{3}$ times	$\frac{5}{\underset{1}{\cancel{2}}} \times \frac{\overset{2}{\cancel{4}}}{3} = \frac{10}{3} = 3\frac{1}{3}$ times

$2\frac{1}{2}$ tons will last $3\frac{1}{3}$ weeks.

2. If $\frac{5}{8}$ of a yard of ribbon will trim one hat, how many hats can be trimmed in the same way from $2\frac{1}{2}$ yards?

3. How much cloth at \$$1\frac{4}{5}$ a yard can be bought for \$$2\frac{3}{20}$?

4. $5\frac{1}{2} \div \frac{4}{5}$
5. $2\frac{3}{7} \div \frac{5}{8}$
6. $5\frac{1}{6} \div 2\frac{1}{3}$
7. $6\frac{2}{3} \div 1\frac{1}{4}$
8. $6\frac{2}{3} \div \frac{3}{4}$
9. $4\frac{1}{5} \div 3\frac{1}{4}$
10. $7\frac{3}{9} \div 4\frac{2}{7}$
11. $5\frac{2}{5} \div 1\frac{1}{9}$

JA

23. *Solve by cancellation:*

1. $1\frac{3}{18} \times 1\frac{2}{7} \times 11\frac{2}{3} \times \frac{12}{20} = ?$ C
2. $1\frac{9}{15} \times \frac{18}{38} \times 2\frac{1}{9} \times \frac{3}{27} = ?$
3. $\frac{4}{21} \times \frac{14}{30} \times 1\frac{2}{26} \times \frac{20}{45} = ?$
4. $\frac{4}{12} \times \frac{6}{9} \times 3\frac{2}{5} \times \frac{3}{34} = ?$

24. *Subtract:*

1. $\begin{array}{r} 900\frac{3}{8} \\ \underline{729\frac{5}{6}} \end{array}$
2. $\begin{array}{r} 932\frac{5}{6} \\ \underline{479\frac{7}{9}} \end{array}$
3. $\begin{array}{r} 316\frac{1}{3} \\ \underline{297\frac{5}{6}} \end{array}$
4. $\begin{array}{r} 631\frac{2}{7} \\ \underline{496\frac{4}{6}} \end{array}$
5. $\begin{array}{r} 824\frac{2}{6} \\ \underline{685\frac{5}{9}} \end{array}$
6. $\begin{array}{r} 905\frac{4}{7} \\ \underline{569\frac{7}{8}} \end{array}$
7. $\begin{array}{r} 807\frac{2}{9} \\ \underline{689\frac{5}{8}} \end{array}$
8. $\begin{array}{r} 721\frac{3}{10} \\ \underline{529\frac{4}{7}} \end{array}$
9. $\begin{array}{r} 570\frac{1}{5} \\ \underline{399\frac{3}{4}} \end{array}$
10. $\begin{array}{r} 321\frac{2}{11} \\ \underline{275\frac{4}{9}} \end{array}$
11. $\begin{array}{r} 453\frac{2}{14} \\ \underline{278\frac{4}{5}} \end{array}$
12. $\begin{array}{r} 712\frac{1}{4} \\ \underline{384\frac{7}{9}} \end{array}$

25. *At sight:*

1. $\frac{6}{7} \div \frac{5}{7}$
2. $\frac{5}{7} \div \frac{6}{7}$
3. $\frac{7}{8} \div \frac{3}{8}$
4. $\frac{3}{8} \div \frac{7}{8}$
5. $\frac{4}{11} \div \frac{3}{11}$
6. $\frac{3}{11} \div \frac{4}{11}$
7. $\frac{6}{13} \div \frac{8}{13}$
8. $\frac{8}{13} \div \frac{6}{13}$
9. $\frac{14}{15} \div \frac{7}{15}$
10. $\frac{7}{15} \div \frac{14}{15}$
11. $\frac{8}{9} \div \frac{6}{9}$
12. $\frac{6}{9} \div \frac{8}{9}$
13. $\frac{12}{14} \div \frac{9}{14}$
14. $\frac{9}{14} \div \frac{12}{14}$
15. $\frac{3}{4} \div \frac{2}{4}$
16. $\frac{2}{4} \div \frac{3}{4}$
17. $\frac{4}{5} \div \frac{3}{5}$
18. $\frac{3}{5} \div \frac{4}{5}$

26. *At sight:*

1. $\frac{1}{6} + \frac{1}{4}$
2. $\frac{9}{10} - \frac{3}{5}$
3. $\frac{5}{12} + \frac{1}{4}$
4. $\frac{3}{4} - \frac{1}{12}$
5. $\frac{5}{6} + \frac{7}{12}$
6. $\frac{7}{12} - \frac{1}{6}$
7. $\frac{3}{16} + \frac{3}{4}$
8. $\frac{3}{4} - \frac{1}{10}$
9. $\frac{3}{5} + \frac{1}{2}$
10. $\frac{2}{5} - \frac{1}{6}$
11. $\frac{1}{2} + \frac{2}{3}$
12. $\frac{15}{16} - \frac{3}{8}$
13. $\frac{2}{5} + \frac{3}{4}$
14. $\frac{6}{7} - \frac{2}{3}$
15. $\frac{5}{9} + \frac{1}{2}$
16. $\frac{5}{6} - \frac{2}{3}$

27. *Find the product:*

1. .96 × .0082
2. 5.4 × .0016
3. 27 × .0637
4. .85 × 4597
5. 36.5 × .078
6. .497 × 86.9
7. 58.7 × .009
8. 625 × 98.7
9. .005 × 98.6
10. 87.5 × 6.89
11. 7.09 × .086
12. .954 × .879

28. *Add:*

1.	2.	3.	4.	5.	6.
989	767	888	574	467	892
567	478	869	866	279	986
868	789	987	977	748	598
987	967	649	457	965	987
655	996	578	488	798	764
478	589	879	789	898	787
769	756	998	799	979	696
887	698	567	763	857	888
886	975	756	898	658	839
989	888	628	888	899	577

29.* *Division of Denominate Numbers.*

1. *For study.* A farmer drew 358 bushels 2 pecks of potatoes to market in 4 loads. Find the average amount carried per load.

Write	Think
	358 bu. ÷ 4 = 89 bu. with 2 bu. remaining
89 bu. $2\frac{1}{2}$ pk.	2 bu. = 8 pk.
4)358 bu. 2 pk.	(8 pk. + 2 pk.) ÷ 4 = $2\frac{1}{2}$ pk.

The average amount carried per load was 89 bu. $2\frac{1}{2}$ pk.

2. The sum of the ages of 30 children is 367 years 6 months. What is the average age of the children?

3. During the 5 school days of the week, Francis studies 3 hours 45 minutes. How much does he average each day?

4. A milkman sold 25 gal. 3 qt. of milk on Monday, 22 gal. 2 qt. on Tuesday, and 28 gal. 3 qt. on Wednesday. What was his average sale per day?

5. If a span of horses ate 3 bu. 2 qt. of oats in 7 days, how much did they eat in one day?

Divide:

6. 12 hr. 25 min. by 8.
7. 1 ton 7 cwt. by 6.
8. 3 gal. 1 qt. by 2.
9. 6 mi. 280 rd. by 5.
10. 25 sq. yd. 6 sq. ft. by 9.
11. 25 pounds 7 ounces by 6.

30. *Written Dictation.*

1. $3 \div \frac{3}{4} = ?$

2. $10 \times 8.4 = ?$

3. Kenneth divided $\frac{3}{5}$ of a melon equally between his brother and his sister. What part of the melon did each receive?

4. If $\frac{3}{8}$ of a farm is valued at $2400, what is the value of the whole?

5. A milliner made 5 bows of ribbon using $\frac{3}{4}$ of a yard in each. How many yards did she use for all?

31. *Find the quotient:*

1. $3\frac{1}{2} \div \frac{2}{3}$
2. $4\frac{1}{7} \div \frac{1}{2}$
3. $4\frac{5}{9} \div \frac{1}{2}$
4. $7\frac{3}{4} \div \frac{5}{8}$
5. $5\frac{1}{6} \div \frac{5}{12}$
6. $6\frac{3}{7} \div \frac{1}{3}$
7. $6\frac{2}{5} \div \frac{1}{2}$
8. $8\frac{2}{3} \div \frac{5}{9}$
9. $4\frac{2}{3} \div \frac{1}{4}$

32. *Add:*

1. 968.40 + 8.906 + .98060 + 8,976.003
2. 7.689003 + 9.764 + .870 + .56 + .6
3. 5.9078 + .698 + 1,097.8 + .76099 + 8.1
4. 7.789 + 2.9876 + .003 + 987.4 + 6,078.098
5. 979.00960 + 2,798.04 + .9 + .09 + 2.003

33. *Find the value of:*

1. $2\frac{1}{7} \times 3\frac{1}{9} \times \frac{9}{28} \times \frac{7}{15} = ?$
2. $3\frac{1}{7} \times 1\frac{3}{11} \times 7\frac{1}{7} \times 6\frac{3}{10} = ?$
3. $\frac{9}{17} \times 5\frac{3}{7} \times \frac{28}{81} \times \frac{7}{24} = ?$
4. $5\frac{5}{6} \times \frac{7}{15} \times 2\frac{2}{5} \times \frac{5}{6} \times 2 = ?$
5. $9\frac{3}{4} \times \frac{6}{13} \times 5\frac{1}{9} \times \frac{6}{23} \times \frac{1}{7} = ?$

34. *Find the difference between:*

1. Two million nine hundred eight thousand sixty and four thousandths; and twenty thousand two and nine thousand eighty-one ten-thousandths.

2. One million seventy-six thousand forty-seven and twelve thousandths; and six hundred ninety-eight thousand nine hundred seventy-five and ninety-six thousandths.

3. Two million three hundred twenty-five thousand two hundred eighty-nine and five hundred seven ten-thousandths; and eighty-nine thousand and seven hundred-thousandths.

4. One million seventeen and six thousand two ten-thousandths; and ninety-eight thousand and sixty-two ten-thousandths.

5. Five million and four millionths; and seventy thousand and seventy thousandths.

35. *Written Problems.*

1. Multiply 50638 thousandths by 92 and 6 hundredths.

2. What will be the profit on 1200 rolls of wall-paper costing 12$\frac{1}{2}$ cents a roll, if sold at an advance of $\frac{1}{3}$?

3. Three persons bought 720 acres of land, the first having $\frac{2}{3}$ and the second $\frac{1}{8}$ of it. Find the value of the third share at $100 per acre.

4. A man owning $\frac{7}{8}$ of a farm sold $\frac{2}{3}$ of his share to A for $2100. What was the value of the farm?

5. A hall is 4 feet wide. How many square yards does its floor contain if the width is $\frac{5}{6}$ of its length?

6. If .375 of a boy's time is spent in sleep, .25 in play, .2 in helping his mother and the remainder in school, what part of his time is spent in school?

7. An ice cream dealer made 12 gallons of ice cream which he froze into bricks containing $\frac{3}{4}$ of a gallon each. How many bricks did he freeze?

8. The product of two numbers is 158,711. One of the numbers is 196. What is the other?

9. A man bought an automobile for $1575; he paid $\frac{2}{5}$ of the amount in cash and $\frac{1}{4}$ of the remainder at the end of 3 months. What amount did he still owe?

10. What will it cost to line an open tank 25 feet long, 20 feet wide and 6 feet high with zinc, at 25¢ a square foot? Make a diagram.

11. Write a receipt for two tons of coal at $8.75, sold to-day by the Carbon Fuel Co. to John Smith.

12. Make and receipt a bill for: 15 yards of cloth at 2\frac{1}{3}$, 9$\frac{2}{3}$ yards of ribbon at $.50; 40 yards of muslin at 22$\frac{1}{2}$ cents.

13. How many jars will be required to hold 4 gal. 2 qt. of maple syrup, if each jar holds one pint?

14. If a man driving an automobile uses a gallon of gasoline for every 12 miles of travel and uses his machine on an average of 36 miles a day, how much is his daily expense for gasoline at 27½¢ a gallon?

15. Re-write, using Roman numerals instead of the italicized words: Two of the most beautiful parts of the Bible are Psalm *Nineteen* and *first* Corinthians, chapter *thirteen.*

16. Last fall the gardener in St. Clair park made a flower bed twelve feet square. In the center he planted a six-foot square with white tulips and filled the rest of the bed with scarlet tulips, allowing six bulbs for each square yard. How many dozen of each did he use? Make a drawing.

17. A tea merchant in Pennsylvania Street asks 20 cents more for half a pound of Oolong than for a quarter of a pound. What is the price of a pound? Diagram.

18. In a certain public school there are 720 pupils. During the term each pupil uses, on the average, five pens, which he purchases at a neighboring drug store at a half-cent each. What is the amount of the druggist's sales? How many gross (12 doz.) are sold?

19. Roy Whitcomb's grandfather gave him some money at Christmas. Roy spent ¾ of it for a box of tools and ½ of the remainder for a pair of skates. He had $1.75 left. How much had he at first?

20. When the new pavement was laid on Meridian Street, $120 was offered for hauling a certain amount of sand from White River Hill. Philip Sanders did the work in twenty days, but James Emery could have done it in fifteen. How much more would he have earned a day than Philip Sanders?

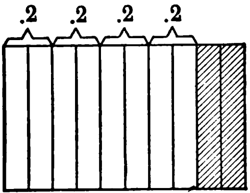
21. The Board of School Commissioners pays 15 cents a yard for picture molding. What is the cost for placing molding on the walls of a twelve-room building, if the average size of each room is 27 × 30 feet?

36.* *Division of a Decimal by an Integer.*

1. *For study.* Mr. Anderson divided a tract of land containing .8 of an acre into 4 lots of equal size. What part of an acre was in each lot?

Solution by Common Fractions	Solution by Decimals
.8 A. = $\frac{4}{5}$ A.	.2 A.
$\frac{4}{5}$ A. ÷ 4 = $\frac{1}{5}$ A.	4).8 A.

There was $\frac{1}{5}$ or .2 of an acre in each lot.



Complete and learn:

When a decimal is divided by an integer the quotient (as in integers) is always of the same denomination as the ——.

2. A stove burned 2.25 tons of coal in 5 weeks. How much did it burn on an average for one week?

3. 384 ÷ 8 = ? 3.84 ÷ 8 = ?
4. 27.6 ÷ 6 = ? .276 ÷ 6 = ?
5. 326.9 ÷ 7 = ? 3.269 ÷ 7 = ?

37. *Add:*

1. $768\frac{2}{3} + 973\frac{5}{7} + 878\frac{3}{14} + 697\frac{9}{21} + 462\frac{3}{8}$
2. $699\frac{5}{6} + 787\frac{3}{11} + 873\frac{1}{2} + 964\frac{2}{3} + 798\frac{5}{9}$
3. $748\frac{5}{8} + 969\frac{1}{6} + 577\frac{3}{4} + 698\frac{7}{8} + 787\frac{1}{3}$
4. $687\frac{7}{10} + 978\frac{5}{12} + 296\frac{9}{24} + 569\frac{7}{8} + 899\frac{3}{7}$
5. $749\frac{5}{9} + 978\frac{3}{6} + 897\frac{29}{30} + 686\frac{3}{4} + 999\frac{7}{18}$
6. $999\frac{5}{8} + 786\frac{5}{6} + 875\frac{3}{5} + 969\frac{6}{15} + 658\frac{2}{3}$

38. *At sight:*

1. $1 \div 5$
$1 \div \frac{1}{5}$
$3 \div 5$
$3 \div \frac{3}{5}$

2. $1 \div 6$
$1 \div \frac{1}{6}$
$6 \div \frac{1}{6}$
$4 \div \frac{4}{6}$

3. $1 \div 7$
$1 \div \frac{1}{7}$
$7 \div \frac{1}{7}$
$7 \div \frac{2}{7}$

4. $1 \div 9$
$9 \div \frac{1}{9}$
$9 \div \frac{5}{9}$
$5 \div \frac{5}{9}$

5. $1 \div 11$
$1 \div \frac{1}{11}$
$11 \div 2$
$2 \div 11$

39. *Multiply:*

1. $6\frac{7}{8}$ by 27
2. $5\frac{5}{6}$ by 15
3. $24\frac{1}{3}$ by 16
4. $6\frac{3}{8}$ by 14
5. $42\frac{3}{5}$ by 12
6. $51\frac{3}{4}$ by 25
7. $56\frac{2}{3}$ by 36
8. $68\frac{5}{6}$ by 18
9. $84\frac{7}{8}$ by 78
10. $94\frac{3}{5}$ by 55
11. $35\frac{3}{8}$ by 28
12. $37\frac{1}{2}$ by 27

40. *Find the quotient:*

1. $4\frac{1}{5} \div \frac{2}{3}$
2. $3\frac{2}{3} \div \frac{7}{8}$
3. $5\frac{1}{9} \div \frac{5}{6}$
4. $2\frac{3}{7} \div \frac{5}{9}$
5. $6\frac{1}{4} \div \frac{3}{8}$
6. $5\frac{3}{4} \div \frac{6}{7}$
7. $8\frac{2}{3} \div \frac{5}{7}$
8. $7\frac{5}{6} \div \frac{7}{9}$
9. $3\frac{3}{8} \div \frac{4}{7}$
10. $2\frac{9}{10} \div \frac{5}{8}$
11. $4\frac{3}{5} \div \frac{5}{6}$
12. $6\frac{7}{8} \div \frac{3}{7}$
13. $7\frac{1}{7} \div \frac{1}{3}$
14. $2\frac{2}{11} \div \frac{5}{9}$
15. $3\frac{3}{13} \div \frac{6}{7}$

41. *Subtract:*

1. $\begin{array}{r} 974\frac{3}{4} \\ \underline{659\frac{5}{6}} \end{array}$

2. $\begin{array}{r} 451\frac{3}{7} \\ \underline{297\frac{5}{8}} \end{array}$

3. $\begin{array}{r} 600\frac{1}{7} \\ \underline{298\frac{2}{3}} \end{array}$

4. $\begin{array}{r} 711\frac{2}{9} \\ \underline{487\frac{5}{8}} \end{array}$

5. $\begin{array}{r} 742\frac{7}{8} \\ \underline{599\frac{8}{9}} \end{array}$

6. $\begin{array}{r} 624\frac{2}{6} \\ \underline{439\frac{5}{7}} \end{array}$

7. $\begin{array}{r} 930\frac{2}{5} \\ \underline{296\frac{5}{6}} \end{array}$

8. $\begin{array}{r} 832\frac{3}{5} \\ \underline{479\frac{5}{9}} \end{array}$

42. *Suggestive Questions in Decimals.*

1. How is the value of 680 changed by dropping the cipher? Of .680?

2. Which is larger .8 or .80? Prove.

3. Write 5283 hundredths.

4. How many decimal places do you associate with the term *tenths?* *Thousandths?*

5. How many decimal places are there in the product when you multiply *one tenth* by *one tenth?* *Two thousandths* by *two tenths?*

43. *Oral Problems.*

1. If a boy walks $6\frac{1}{4}$ miles per day, on an average, for 5 days, how many miles does he walk in all?

2. If you can buy 4 oranges for 10¢, how much must you pay for 1 dozen oranges?

3. If a workman can mold 3 flowerpots in 5 minutes, how many can he mold per hour?

4. Two watchmen relieved each other every 6 hours. How many times did each one watch during one week?

5. How much bunting at \$$\frac{3}{5}$ a yard, can be bought for \$12?

6. If a dealer buys 15 quarts of berries from one man, 24 quarts from another, and 18 quarts from a third and sells 39 quarts, how many quarts has he left?

7. What number must be added to .7 to make 2.4?

8. A board $\frac{7}{8}$ of an inch thick is planed down $\frac{1}{4}$ of an inch. How thick is it then?

9. What is the number from which if $3\frac{1}{4}$ is taken the result is $1\frac{1}{2}$?

10. In a certain farm 60 acres are meadow land. This is $\frac{3}{8}$ of all the farm. How many acres in the farm?

11. A clerk's salary is \$160 a month and his expenses are $\frac{5}{8}$ of his income. What amount does he save each month?

12. Is it better to buy for \$6 and sell for \$6.50, or to sell for \$8 what is bought for \$7?

13. At $\frac{5}{8}$ of a dollar per yard, how many yards can be bought for \$5?

14. Find the total snowfall for two winters in Ohio, if it was 56.3 inches one winter and 31.2 inches the next winter.

15. Helen spent $\frac{2}{3}$ of her money for a doll. If the doll cost 60¢, how much money had she at first?

44.* *Division of Decimals or Integers by* 10 *and its Powers.*

Preliminary Exercise.

a. 500 ÷ 10 = ? 7000 ÷ 100 = ?

Dividing hundreds by 10 gives tens.

b. 50 ÷ 10 = ? 700 ÷ 100 = ?

Dividing tens (or units larger than 10) by 10 gives ——.

c. 5.0 ÷ 10 = ? 70.0 ÷ 100 = ?

Dividing units by 10 gives tenths.

d. .50 ÷ 10 = ? 7.00 ÷ 100 = ?

Dividing tenths by 10 gives ——.

e. .050 ÷ 10 = ? .700 ÷ 100 = ?

Dividing hundredths by 10 gives ——. Continue.

Connect this with decimal notation and also with exercise 79, page 182.

1. *For study.* In every 10 pounds of potatoes are 7.80 pounds of water. What is the weight of water to be found in 1 lb. of potatoes?

Write	Think	
.78 lb.	.78 lb.	10 is not contained in 7 units.
10)7.80 lb.	10)7.80 lb.	$\frac{1}{10}$ of 78 tenths = 7 tenths with a remainder of 8 tenths.
	7 0	
	80	8 tenths = 80 hundredths.
	80	$\frac{1}{10}$ of 80 hundredths = 8 hundredths

There will be .78 lb. of water in 1 lb. of potatoes.

2. *For study.* A dealer sold 100 books for $96. What is the price per book?

Write	Think	
$ .96	$ 0.96	100 is not contained in 96 units.
100)$96.00	100)$96.00	$\frac{1}{100}$ of 960 tenths = .9 with 60 tenths remainder.
	90 0	
	6 00	60 tenths = 600 hundredths.
	6 00	$\frac{1}{100}$ of 600 hundredths = .06

Each book will cost $.96.

3. One year a farmer cut 37.5 tons of hay from a field of 10 acres. Find the average yield per acre.

4. One hundred cars carried 6548 tons of coal. Find the average amount of coal in each car.

5. The cost of building a dirt road 100 miles long was $49,020.30. What was the cost per mile?

6. Divide at sight by 10, by 100, by 1000:

a. 68,967
b. 765.47
c. 8766.9
d. 800.65
e. 78.976
f. 97,854
g. 487.56
h. .39847
i. 60,789

> *Complete and learn:*
>
> The short way to divide an integer or a decimal by 10 or a power of 10 is to move the decimal point in the dividend as many places toward the —— as there are ciphers in the divisor.

7. *For study.*

a. 8.64 ÷ 20 = ?
8.64 ÷ 10 = .864
.864 ÷ 2 = .432
Therefore 8.64 ÷ 20 = .432

b. 76 ÷ 400 = ?
76 ÷ 100 = ?
.76 ÷ 4 = ?
76 ÷ 400 = ?

8. 875 ÷ 5
875 ÷ 50
875 ÷ 500
875 ÷ 5000

9. 6.96 ÷ 6
6.96 ÷ 60
6.96 ÷ 600
6.96 ÷ 6000

10. 42.7 ÷ 7
42.7 ÷ 70
42.7 ÷ 700
42.7 ÷ 7000

C

45. *Multiply:*

1. 644 by $86\frac{5}{7}$
2. 672 by $57\frac{5}{8}$
3. 768 by $96\frac{3}{4}$
4. 873 by $27\frac{5}{9}$
5. 855 by $67\frac{8}{9}$
6. 867 by $75\frac{2}{3}$
7. 828 by $49\frac{5}{9}$
8. 695 by $36\frac{4}{5}$
9. 522 by $96\frac{5}{6}$
10. 695 by $47\frac{4}{5}$ X
11. 945 by $86\frac{6}{7}$
12. 789 by $67\frac{2}{3}$

46. *Find the quotient at sight:*

1. $3 \div 4$
2. $3 \div 8$
3. $5 \div 8$
4. $7 \div 8$
5. $32 \div 8$
6. $32 \div 80$
7. $35 \div 7$
8. $35 \div 70$
9. $16 \div 80$
10. $75 \div 125$
11. $62.5 \div 125$
12. $.875 \div 12.5$

47. *Find the product:*

1. $265\frac{7}{8} \times 984$
2. $796\frac{4}{5} \times 795$
3. $964\frac{3}{7} \times 287$
4. $264\frac{5}{6} \times 396$
5. $765\frac{2}{3} \times 504$
6. $296\frac{3}{4} \times 788$
7. $174\frac{2}{9} \times 927$
8. $254\frac{2}{5} \times 785$
9. $398\frac{3}{8} \times 856$
10. $289\frac{5}{7} \times 686$
11. $279\frac{3}{5} \times 960$
12. $359\frac{1}{6} \times 546$
13. $768\frac{6}{7} \times 756$
14. $286\frac{5}{8} \times 656$
15. $768\frac{5}{9} \times 792$

48. *Find the quotient:*

1. $9\frac{2}{5} \div \frac{1}{2}$
2. $3\frac{9}{10} \div \frac{5}{6}$
3. $8\frac{7}{8} \div \frac{3}{4}$
4. $6\frac{5}{6} \div \frac{2}{3}$
5. $7\frac{1}{2} \div \frac{7}{9}$
6. $2\frac{1}{2} \div \frac{3}{8}$
7. $8\frac{4}{5} \div \frac{5}{6}$
8. $2\frac{8}{9} \div \frac{1}{3}$
9. $12\frac{3}{7} \div \frac{1}{8}$
10. $6\frac{8}{9} \div \frac{1}{4}$
11. $7\frac{5}{7} \div \frac{1}{2}$
12. $9\frac{2}{3} \div \frac{4}{5}$

49. *Subtract:*

1. $\begin{array}{r} 7468\frac{2}{3} \\ \underline{2099\frac{9}{10}} \end{array}$
2. $\begin{array}{r} 6482\frac{3}{8} \\ \underline{5009\frac{6}{17}} \end{array}$
3. $\begin{array}{r} 3400\frac{1}{8} \\ \underline{2999\frac{7}{9}} \end{array}$
4. $\begin{array}{r} 4905\frac{1}{5} \\ \underline{1607\frac{5}{9}} \end{array}$
5. $\begin{array}{r} 6902\frac{2}{15} \\ \underline{5298\frac{8}{11}} \end{array}$
6. $\begin{array}{r} 8270\frac{7}{9} \\ \underline{5908\frac{10}{11}} \end{array}$
7. $\begin{array}{r} 8900\frac{2}{5} \\ \underline{8789\frac{7}{13}} \end{array}$
8. $\begin{array}{r} 7865\frac{2}{7} \\ \underline{4987\frac{4}{5}} \end{array}$

50. *At sight:*

1. $\frac{1}{3} \div \frac{3}{4}$
2. $\frac{3}{4} \times \frac{5}{6}$
3. $\frac{4}{5} \div \frac{4}{7}$
4. $\frac{2}{9} \times \frac{9}{4}$
5. $\frac{6}{7} \div \frac{2}{5}$
6. $\frac{7}{8} \times \frac{3}{5}$
7. $\frac{7}{9} \times \frac{5}{6}$
8. $\frac{6}{8} \div \frac{1}{5}$
9. $\frac{5}{6} \times \frac{7}{8}$
10. $\frac{2}{3} \div \frac{2}{5}$
11. $\frac{4}{7} \times \frac{3}{5}$
12. $\frac{4}{5} \div \frac{4}{9}$
13. $\frac{5}{12} \times \frac{1}{3}$
14. $\frac{4}{5} \div \frac{5}{7}$
15. $\frac{5}{9} \times \frac{2}{3}$
16. $\frac{5}{6} \times \frac{5}{8}$
17. $\frac{6}{7} \div \frac{6}{11}$
18. $\frac{3}{8} \times \frac{5}{7}$
19. $\frac{6}{7} \div \frac{5}{8}$
20. $\frac{5}{9} \times \frac{3}{4}$

51. *A Summer Camp — The Circle. Written.*

1. Mr. Mills took 5 boys to Spring Lake. The boys made tepee tents before starting. Each tent required 5 yards of cotton cloth 90 inches in width. Make a paper model on a scale of 1 inch to the foot. See Boy Scout Manual.

a. The diameter of the tepee is —— feet.

b. The circumference of the base of the tepee is —— feet.

The base of the tepee tent is approximately a circle.

2. The boys took with them the following rations. What was the cost at today's prices at your grocery store?

4 pounds bacon (sliced thin)
2 pounds butter
2 dozen eggs
1 pound cocoa
1 pound coffee
2 pounds sugar
6 cans salmon
1 peck potatoes
4 cans condensed milk
2 small packages of self-raising flour.

Include 10¢ for salt and pepper.

3. Theodore had $12 and spent .75 of his money for a kodak and .50 of what remained for a fishing outfit. How much money had he left?

4. Each boy rode his bicycle. The diameter of one wheel was 2 feet 4 inches. How many feet did the bicycle travel in each revolution? How many revolutions did the wheel make in going the 5 miles to the lake? **Bring a bicycle into the schoolroom for actual measurement.**

5. At night they sat in a ring about the camp fire and told Indian stories. Each boy was about 5 feet from the center of the fire. How far did a box of candy travel that went around the complete circle? Why is your answer only approximately correct?

6. At 11 o'clock Robert and Walter, the two best swimmers, had a contest. It took Robert 40 seconds to swim 40 yards and Walter only .9 of that time. What fraction of a minute did it take Walter?

7. The boys had target practice with bow and arrow. Each boy had a bow 5 feet long and arrows 28 inches long. Before the bow was distended the string was 5 inches from the middle of the bow. When the string was distended ready for shooting, the arrow projected 5 inches beyond the bow. How much farther was the string from the bow than it originally was?

8. The boys took turns in carrying water from a spring .3 of a mile away. Four trips were made daily. How many yards did the boys walk each day in bringing water to the camp?

9. Mr. Mills taught the boys how to make a sun dial. He took the top of a cask which they found on the beach and divided the circumference equally into 24 parts. The diameter of the dial was 12 inches. About how far apart was each figure from the next?

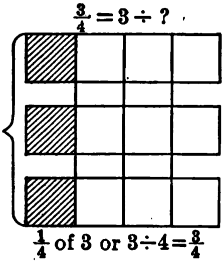
Complete and learn:

The circumference of a circle is about $3\frac{1}{7}$ times the length of the ——.

52.* *Reduction of Common Fractions to Decimals — concluded.*

Preliminary Exercise.

$\frac{3}{4} = 3 \div ?$



$\frac{7}{8} = 7 \div ?$
$\frac{5}{6} = ? \div ?$
$\frac{4}{5} = ? \div ?$

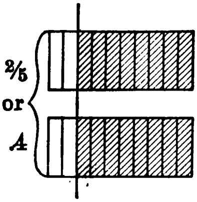
Review exercise 50, page 160. Make sure also that the pupils understand the fundamental difference between common fractions and decimal fractions.

Complete and learn:

A common fraction is an indicated division. The numerator of the fraction is the —— and the denominator is the ——.

1. *For study.* $\frac{2}{5}$ = what decimal fraction?

$2 = 2.0$
$\frac{2}{5} = 2.0 \div 5 = .4$



2. *a.* $\frac{1}{4}$
b. $\frac{3}{4}$

3. *a.* $\frac{1}{5}$
b. $\frac{4}{5}$

4. *a.* $\frac{1}{20}$
b. $\frac{7}{20}$

5. *a.* $\frac{1}{16}$
b. $\frac{3}{16}$

6. *a.* $\frac{1}{25}$
b. $\frac{3}{25}$

7. *a.* $\frac{1}{3}$
b. $\frac{2}{3}$

8. *a.* $\frac{1}{8}$
b. $\frac{5}{8}$

9. *a.* $\frac{1}{6}$
b. $\frac{5}{6}$

Complete and learn:

To reduce a common fraction to a decimal fraction divide the —— of the common fraction by its ——. The quotient is the decimal fraction.

53. *Divide at sight:*

1. $9.75 \div 50$
2. $296 \div 80$
3. $7.20 \div 90$
4. $.576 \div 30$
5. $2.84 \div 40$
6. $72.3 \div 30$

54. *Change to decimals:*

1. $\frac{5}{25}$
2. $\frac{3}{5}$
3. $\frac{6}{25}$
4. $\frac{2}{5}$
5. $\frac{7}{25}$
6. $\frac{9}{50}$
7. $\frac{7}{20}$
8. $\frac{2}{50}$
9. $\frac{8}{25}$
10. $\frac{9}{20}$
11. $\frac{13}{50}$
12. $\frac{3}{20}$

55. *Divide:*

1. $8\frac{7}{9} \div \frac{4}{5}$
2. $2\frac{5}{6} \div \frac{7}{8}$
3. $7\frac{3}{4} \div 2\frac{1}{6}$
4. $9\frac{1}{2} \div 3\frac{2}{3}$
5. $5\frac{7}{8} \div 1\frac{2}{5}$
6. $2\frac{3}{4} \div 1\frac{5}{7}$
7. $6\frac{1}{3} \div 2\frac{1}{2}$
8. $7\frac{2}{7} \div 5\frac{1}{3}$
9. $2\frac{2}{3} \div \frac{5}{6}$
10. $7\frac{1}{4} \div 2\frac{5}{8}$
11. $2\frac{8}{9} \div 1\frac{6}{7}$
12. $9\frac{2}{3} \div 3\frac{1}{5}$

56. *Solve by cancellation:*

1. ✓ $3\frac{3}{4} \times 2\frac{1}{5} \times \frac{8}{9} \times \frac{7}{11} = ?$
2. $12\frac{1}{2} \times 11\frac{1}{5} \times 1\frac{1}{8} \times 3\frac{1}{3} \times \frac{2}{15} = ?$
3. $2\frac{4}{\text{[illegible]}} \times 1\frac{1}{7} \times 1\frac{7}{\text{[illegible]}} \times 2\frac{1}{\text{[illegible]}} \times \frac{3}{15} = ?$
4. $4\frac{1}{2} \times \frac{6}{7} \times 12\frac{2}{3} \times 1\frac{2}{19} \times 1\frac{1}{3} = ?$
5. $2\frac{2}{3} \times 1\frac{7}{18} \times 5\frac{2}{5} \times \frac{7}{15} \times \frac{3}{28} = ?$
6. $2\frac{1}{9} \times 1\frac{11}{38} \times 2\frac{4}{7} \times \frac{3}{21} \times \frac{1}{18} = ?$
7. $1\frac{3}{4} \times 4\frac{1}{2} \times 1\frac{10}{14} \times 1\frac{2}{9} \times \frac{4}{9} = ?$
8. $8\frac{1}{2} \times 1\frac{8}{34} \times 2\frac{2}{7} \times 1\frac{7}{8} \times 2\frac{4}{5} = ?$

57. *Multiply in the easier way:*

1. $\frac{3}{7} \times 15$
2. $\frac{3}{7} \times 49$
3. $\frac{2}{5} \times 30$
4. $\frac{2}{5} \times 17$
5. $\frac{7}{8} \times 51$
6. $\frac{7}{8} \times 64$
7. $\frac{6}{7} \times 84$
8. $\frac{6}{7} \times 72$
9. $\frac{4}{13} \times 91$
10. $\frac{4}{13} \times 25$
11. $\frac{5}{8} \times 72$
12. $\frac{5}{8} \times 53$
13. $\frac{4}{5} \times 16$
14. $\frac{4}{5} \times 15$
15. $\frac{5}{12} \times 36$
16. $\frac{5}{12} \times 38$
17. $\frac{7}{16} \times 64$
18. $\frac{7}{16} \times 63$
19. $\frac{3}{4} \times 44$
20. $\frac{3}{4} \times 33$
21. $\frac{5}{6} \times 23$
22. $\frac{5}{6} \times 42$
23. $\frac{9}{14} \times 17$
24. $\frac{9}{14} \times 42$

58.* *Practical Measurements — Carpeting.*

1. *For study.* How many yards of carpet 27 inches wide will be needed to cover the floor of a room 12 feet wide and 18 feet long if the strips run crosswise? Draw a plan of the room.

Analysis

27 inches = $\frac{3}{4}$ of a yard.
18 feet = 6 yards.
6 yd. ÷ $\frac{3}{4}$ yd. = $\frac{24}{3}$ or 8 times.
12 ft. = 4 yd., the length of each strip.
8 × 4 yd. = 32 yd.

There will be needed 32 yards of carpet to cover the floor.

2. How many yards of carpet would it take if the strips had run lengthwise? Remember that you cannot buy a fraction of a strip of carpet.

3. A certain carpet has an 18-inch pattern to be matched. Will there be any waste in matching if the strips are 18 feet long? If they are 16 feet long?

4. What will it cost to carpet a room 12 feet by 24 feet with 27-inch carpet at $1.20 a yard?

5. What is the width of a piece of oilcloth 16 yards long that contains 20 square yards?

6. How many yards of carpet $\frac{3}{4}$ yd. wide will be needed to cover a floor containing 56 sq. yd.?

7. How many yards of carpet one yard wide must be purchased for a floor 16 feet wide and 24 feet long when the strips run lengthwise?

8. How many yards of carpet will be required to cover a stair of 15 steps with a 10-inch tread and 7 inch rise? Allow one yard extra for finishing the carpeting at the top and bottom of the staircase.

59.* *Division of Integers or Decimals by Decimals.*

Preliminary Exercise.

a. $8 \div 4 = 2$ *b.* $80 \div 40 = 2$ *c.* $800 \div 400 = 2$

Continue.

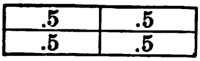
Complete and learn:

Multiplying both dividend and divisor by the —— number does not change the quotient.

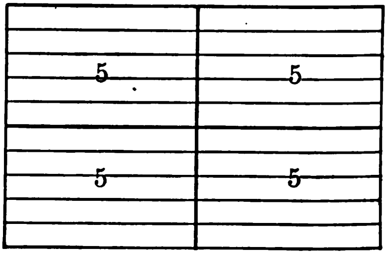
1. *For study.* At $.50 a pair how many pairs of hose can be bought for $2?

Solution by Common Fractions	Solution by Decimals
$\$2.00 = \$\frac{4}{2}$	$10 \times \$.50 = \$5.00$
$\$.50 = \$\frac{1}{2}$	$10 \times \$2.00 = \$20.00$
$\frac{4}{2} \div \$\frac{1}{2} = 4$ times	$\$2.00 \div \$.50 = \$20.00 \div \$5.00 = 4$ times

Four pairs of hose can be bought for $2.00.



$2 \div .5 = 4$



$20 \div 5 = 4$

In dividing by a decimal, if the dividend and the divisor are multiplied by a number that will make the divisor an integer, we can divide as on page 213.

2. *For study.*

$.6\overline{).36}$ (multiplying both terms by 10) $\begin{array}{r} .6 \\ 6\overline{)3.6} \end{array}$

3. *For study.*

$.003\overline{).6}$ (multiplying both terms by 1000) $\begin{array}{r} 200 \\ 3\overline{)600} \end{array}$

Continue.

60. *Suggestive Questions on Thrift and Economy.*

"Keep thy shop and thy shop will keep thee."

— Franklin.

1. Why is economy not only wise but righteous? What is the difference between being economical and being penurious?

2. Why is health economical? Cheerfulness?

3. How can a pupil in school practice economy in time and in materials?

4. Name one thing that shows that economy is practiced in your school. If you see some way by which a further economy would benefit it, offer it respectfully to your teacher.

5. What is meant by people "living beyond their means"?

6. Why is "system" always necessary to economy? Give examples from the home and from business.

7. What does the thrifty housewife do with the following: skimmed milk, bacon rind, fat fryings? Name two appetizing dishes which can be made from "left-overs."

8. Discuss the relative cost of home-made bread with that ordered by telephone, machine wrapped, delivered by wagon and bought upon credit.

9. Why have the merchants of the country made a concerted objection to delivering small parcels? To sending out goods on approval?

10. How does an account book of weekly expenses help to make a housewife economical?

11. It is said that 50% of all the fruits and vegetables in the country rot on the ground because they cannot be marketed. What is our national duty about them?

12. What in general can be said of buying on the installment plan? When is it economical to buy at a bargain sale? When not?

13. Make an original problem about the proverb "A stitch in time saves nine."

14. What can be said about the waste caused by the frequent change in the fashion in dress?

15. Is it more economical to walk 5 miles or to pay 5¢ for a street car ride? Why?

16. Discuss the relative values of paying for a seat to hear a great artist render a fine musical selection and paying the same price for a phonographic record of the music.

17. Do you advise co-operative bakeries, laundries and markets?

18. Discuss the advantages and disadvantages of consolidating certain lines of business so that a few firms handle it all. Can this business be regulated?

19. Is it solely to prevent theft that in all large manufacturing plants each employee is required to account for all of his tools each evening?

20. Why do municipalities and railroads require their men to buy their own uniforms?

21. Discuss the city board of health as an economic factor in the life of the community.

22. Why does the city require a building permit before any building can be erected? How does your city regulate the construction of new buildings?

23. Why do most cities have an ordinance requiring that a city gas company furnish a certain percentage of candle power and heat units with each thousand feet of gas to the consumer?

24. Name some things that the federal government has done to insure pure food, eradicate disease, protect game and fish, and conserve water and forests.

"For want of a nail the shoe was lost,
For want of a shoe the horse was lost,
For want of a horse the rider was lost.
For want of a rider, the battle was lost
And all for the want of a horse-shoe nail."

61.* *Finding the Value of the Whole when that of a Decimal Part is Given.*

1. *For study.* A man's expenses are $40 a month. This is .8 of his salary. What is his salary?

Solution by Common Fractions	Solution by Decimals
$\frac{8}{10}$ of his salary = $40	.8 of his salary = $40
$\frac{1}{10}$ of his salary = $40 ÷ 8 = $5	.1 of his salary = $40 ÷ 8 = $5
$\frac{10}{10}$ or his salary = 10 × $5 = $50	1.0 or his salary = 10 × $5 = $50

His salary is $50.

2. Ralph spent $24 for a bicycle which was .3 of all his money. How much money had he?

3. Helen's age is .4 of her father's age. Helen is 16 years old. How old is her father?

4. In a certain school .6 of all the pupils were girls. There were 28 boys in the school. How many pupils were in the school?

5. There remained 40 sheep in a flock after .8 were sold. How many were sold?

62. *Divide:*

1. 2.95 ÷ .07
2. .8676 ÷ 1.2
3. 5642 ÷ .7
4. 42.03 ÷ .06
5. 780.6 ÷ .92
6. 8.706 ÷ 1.18
7. 1.709 ÷ .76
8. .8499 ÷ 1.9
9. 150.6 ÷ 4.2
10. 2.12 ÷ 12.6
11. 9.42 ÷ 7.4
12. 1.56 ÷ 2.72

Do not carry the quotient more than two decimal places.

63. *At sight:*

1. .8 of 24 = ? 24 is .8 of ?
2. .6 of 18 = ? 18 is .6 of ?
3. .5 of 35 = ? 35 is .5 of ?
4. .9 of 27 = ? 27 is .9 of ?
5. .7 of 21 = ? 21 is .7 of ?
6. .03 of 12 = ? 12 is .03 of ?
7. .04 of 16 = ? 16 is .04 of ?
8. .05 of 20 = ? 20 is .05 of ?
9. .6 of 30 = ? 30 is .6 of ?
10. .06 of 30 = ? 30 is .06 of ?

64. *Find the quotient:*

1. $4\frac{1}{3} \div 2\frac{1}{2}$
2. $12\frac{1}{2} \div 3\frac{1}{4}$
3. $8\frac{3}{4} \div 1\frac{1}{8}$
4. $7\frac{5}{6} \div 2\frac{3}{4}$
5. $6\frac{3}{4} \div 3\frac{1}{2}$
6. $6\frac{2}{3} \div 5\frac{1}{9}$
7. $6\frac{2}{5} \div 3\frac{2}{3}$
8. $7\frac{1}{5} \div 2\frac{1}{4}$
9. $7\frac{1}{2} \div 2\frac{1}{5}$
10. $4\frac{1}{7} \div 1\frac{1}{2}$
11. $6\frac{5}{7} \div 1\frac{3}{14}$
12. $5\frac{1}{6} \div 1\frac{6}{7}$

$\frac{9}{7}$

5

7⟌94

$\frac{25}{9}$

65. *Written Dictation.*

1. Divide $\frac{1}{2}$ by $\frac{1}{3}$.

2. Write $\frac{3}{20}$ as a decimal.

3. A boy having 18 miles to go rode $\frac{7}{9}$ of the distance with his neighbor and walked the rest of the way. How far did he walk?

4. A passenger train leaves Chicago at 9:50 A.M. and arrives at Topeka at midnight. How long is it on the way?

5. A man owning $\frac{2}{3}$ of a mill sold $\frac{1}{3}$ of his share. What part of the mill did he sell?

66. *Find quotient:*

1. $783.83 \div 3.69$
2. $5465.4 \div 37.8$
3. $51.503 \div .397$
4. $1.387 \div 197$
5. $102.41 \div 1.78$
6. $94.4 \div 19.7$

67. *Add:*

1.	2.	3.	4.	5.	6.
867	568	687	997	897	954
978	879	563	976	698	879
698	655	491	468	976	698
476	789	784	689	597	789
884	834	865	957	849	597
699	496	237	873	786	686
896	645	572	745	497	859
574	968	528	798	569	867
537	787	697	889	976	996
675	879	854	967	879	978

68. *Oral Problems.*

1. Several years ago 14,000 persons were engaged in making gloves in the United States. Of this number $\frac{3}{10}$ were men. How many women were employed at the trade?

2. There were 20 girls in a cooking class. In making pies each girl used $\frac{3}{4}$ of a cup of flour. How much flour did the whole class use?

3. Two men are working on the same job at the same wages. One man worked 4 hours and the other 5 hours. Together they receive $27. What is each man's share?

4. A 10-pound can of coffee sells for $3.30. What is saved if this coffee costs 35¢ when bought by the single pound?

5. If 4 men can do a piece of work in 8 days, how long will it take 2 men to do the work?

6. Arnold practices on his violin $\frac{3}{4}$ of an hour each day. It took him 3 hours to learn his new exercise. How many days did he practice?

7. One dozen Leghorn eggs weighed 16 ounces. This was .8 of the weight of one dozen Plymouth Rock eggs. What was the weight of the latter?

8. At $6\frac{1}{4}$¢ a yard what will 8 yards of braid cost?

9. At 25¢ each how many drawing books can be bought for 15 dimes?

10. How much will it cost to sod a lawn 15 × 18 feet at 22¢ a square yard?

11. If a boy pays $2.50 a hundred for papers and sells them at 5 cents each, how much does he make on one paper?

12. How many boxes each holding $\frac{1}{6}$ of a gallon will be required to hold $3\frac{1}{3}$ gallons of berries?

13. 3 quarts 1 pint are what part of a gallon?

14. 2 feet 3 inches are what part of a yard?

69. *Reduce to common fractions in their lowest terms:*

1. .6708
2. 1.720
3. .2605
4. .0020
5. .7500
6. 2.250
7. .3205
8. .7006
9. .9020
10. .0008
11. .5000
12. 2.002
13. .2095
14. .0055
15. .7860
16. 1.008
17. 1.800
18. .9808
19. .5005
20. .0505

70. *Find the product:*

1. 2.09 × .68
2. 8.6 × 60.080
3. 4.94 × .0408
4. .872 × 2.9
5. 78.4 × 36.74
6. .006 × .0005
7. .056 × 2.398
8. .98 × 9.83
9. 8.7 × .0096
10. 7.65 × 5.8
11. 834 × 3.04
12. .065 × 4.8
13. 45.0 × 4.890
14. 7.62 × .0068
15. 9.92 × 7.643

Do not use unnecessary ciphers.

71. *At sight:*

1. 100 ÷ 2
10 ÷ 2
1 ÷ 2
.1 ÷ 2
.01 ÷ 2

2. 625 ÷ 25
625 ÷ 2.5
6.25 ÷ 25
625 ÷ .25
.625 ÷ 25

3. 8 ÷ 2
8 ÷ .2
.8 ÷ .2
8 ÷ .02
.8 ÷ .02

4. 256 ÷ 16
256 ÷ 1.6
25.6 ÷ 16
256 ÷ .16
.256 ÷ .16

5. 9 ÷ 3
.9 ÷ 3
9 ÷ .3
9 ÷ 30
.9 ÷ .03

6. 324 ÷ 18
.324 ÷ 18
.324 ÷ 1.8
.324 ÷ .18
3.24 ÷ .18

7. 240 ÷ 80
240 ÷ .80
2.40 ÷ 80
2.40 ÷ .80
.240 ÷ 80

8. 361 ÷ 19
361 ÷ 1.9
361 ÷ .19
36.1 ÷ .19
3.61 ÷ .19

72. *Complete and learn:*

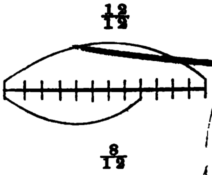
a. 1 × 17 = 17
2 × 17 = 34
to
5 × 17 = 85

b. 85 ÷ 17 = 5
68 ÷ 17 = 4
to
17 ÷ 17 = 1

c. 85 ÷ 5 = 17
68 ÷ 4 = 17
to
17 ÷ 1 = 17

73.* *Finding what Fractional Part One Number is of Another.*

1. *For study.* A 12-lb. turkey weighed 8 lb. after being dressed. The weight of the dressed turkey was what part of the live turkey?



Analysis

12 lb. = $\frac{12}{12}$ of live turkey
1 lb. = $\frac{1}{12}$ of live turkey
8 lb. = $\frac{8}{12}$ of live turkey
$\frac{8}{12} = \frac{2}{3}$

The weight of the dressed turkey was $\frac{2}{3}$ of the weight of the live one.

2. *Give analysis:* What part of:

a. 9 is 3?

For Study

1 = $\frac{1}{9}$ of 9
3 = $\frac{3}{9}$ or $\frac{1}{3}$ of 9

b. 16 is 4?
c. 15 is 9?
d. 29 is 8?
e. 30 is 9?

3. Alice takes 40 minutes ($\frac{2}{3}$ of an hour) to learn her lesson. She has 20 minutes ($\frac{1}{3}$ of an hour) before school to study. What part of her lesson can she learn?

4. Three boys club together to buy a bat that costs 90¢. Claude puts in 15¢. What is his share of ownership?

5. The three boys buy 4 balls for $2. John puts in 50¢. What part of the balls does John own?

6. A motor car is going at the rate of 40 miles an hour. How far does it go in 15 minutes?

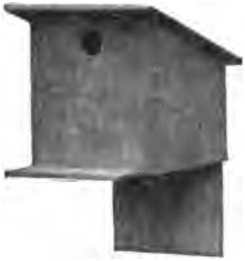
7. Of the 30 boys in the sixth grade, 28 were promoted. What part was not promoted?

8. Mr. White feeds his horse 12 qt. of oats per day. What part of a bushel does the horse eat each day?

9. Mr. Baker raised 72 tons of hay and sold 42 tons. What part of his crop did he keep?

10. What part of a day is 6 hours? 9 hours?

74. *Meadowbrook Farm: XIV — Inviting the Birds — Written.*



1. Paul and Tom Henderson made a wren house like the one pictured. Construct one like it.

Front	5″ × 8″	Bottom	5″ × 8″
Back	5″ × 6″	Roof	10″ × 8″
Sides	$3\frac{3}{4}$″ × 8″ × 6″		

Measurements for stiff paper construction.

Allow $\frac{1}{2}$ inch on each dimension for a flap. What are the measurements of the smallest sized paper that would cut any one of these?

2. The door was $\frac{3}{4}$ of an inch in diameter. What was its circumference?

3. The boys nailed the new bird house under the eaves of the porch. The roof of the porch was 12 feet above the ground and the eaves .9 of that distance. How high was the bird house above the ground?

4. During the summer there were 3 broods of young wrens. In the first brood were 4 birds. This was .8 of the number of birds in the second brood. In the third brood were $\frac{2}{3}$ as many birds as in the other two broods combined. How many birds in the three broods?

5. High up in the elm tree hung the nest of a Baltimore oriole. One day old Tabby concluded that she would like some nice young birds to eat. After climbing 28.7 feet up the trunk of the tree, she ventured out 12.5 feet on a limb. Finding it too slender to support her, she climbed back to the ground. What was the length of her journey?

6. One May morning Alice found a robin's nest in the lilac bush. Two tiny birds and 3 blue eggs were in the nest. Make us an interesting problem about the robins.

7. The children took great pleasure in watching a pair of robins who flew to the cherry tree each morning. Father didn't mind the cherries they ate, for that was only .25 of their food. The rest consisted of insects that harmed the trees. If each robin ate on an average 75 insects a day, how many insects would the pair destroy during the month of June?

8. Mr. Henderson was pestered with crows who pulled up his sprouting corn. He rigged up a scarecrow which on the first day frightened away two flocks of crows. In the first flock were 36 crows. This was .60 of the number in the second flock. How many crows in both flocks?

9. On the next day 65 of the crows returned to the cornfield. Of these only .4 were frightened away. How many crows remained to eat corn?

10. About a month later, Mr. Henderson found a nest in the scarecrow's pocket which contained 6 crow's eggs. Had they all hatched and each had brought up a brood of 6 crows the next year, and these young crows had each brought up a brood of 6 crows the third year, how many crows would have hatched the third year? Ask your teacher to explain what is meant by a genealogical tree. Make one for this crow family.

11. The window of the boys' bedroom was 13.8 feet above the ground. This was 9.7 feet below a hole in a tree where a pair of owls nested. How high was the nest from the ground?

75.* *Fractional Parts of One Dollar.*

When one number divides another exactly it is said to be an aliquot part of that number. For example: 25 is an aliquot part of 100 but it is not an aliquot part of 80.

1. *For study.* At $.50 a dozen, how much will 12 dozen eggs cost?

Solution by Long Multiplication	Solution by Aliquot Parts
12 × $.50 = $6.00	$12 \times \$\frac{1}{2} = \$\frac{12}{2} = \$6$

12 dozen eggs will cost $6.

2. At $.40 ($\$\frac{2}{5}$) a doz., how many peanut butter cartons can be bought for $8?

3. At $.80 an hour, how much will a man earn in 2 days of 8 hours each?

4. How much will 24 lb. of raisins cost at $.25 a lb.?

5. How many dozen lemons can be bought for $5 at $.25 a dozen?

6. Find the cost at wholesale of :

(1) 19 books at 25¢.
(2) 25 balls at 25¢.
(3) 18 thimbles at 75¢.
(4) 25 lb. of pecans at $.80.
(5) 12 clocks at $1.20.
(6) 16 yd. gingham at 60¢.

76. *Add:*

1.	2.	3.	4.	5.	6.
876	767	599	996	797	578
587	987	968	998	498	689
997	475	746	689	998	997
788	589	999	689	656	658
675	889	897	999	999	898
967	878	766	897	668	698
799	698	779	288	769	989
797	796	897	798	987	986
896	999	789	897	949	796
869	878	878	978	888	997

77. *Written Dictation.*

1. Write in Roman numerals: 1917.

2. Write in words: .1005.

3. Add: $\frac{1}{4} + \frac{1}{3} + \frac{7}{12}$.

4. Elizabeth had $\frac{7}{8}$ of a yard of silk with which she was going to make 3 dresses for her doll. If she used the same amount for each dress, how much would be required for one of the dresses?

5. In February there were 8 inches of snow on the ground. In March the snow was only .75 as deep. How deep was the snow in March?

78. *Find the quotient:*

(1) $90.026 \div 296$
(2) $378.43 \div 1.87$
(3) $2707.5 \div 27.8$
(4) $4481.6 \div 2.86$
(5) $54.343 \div 19.7$
(6) $502.36 \div 1.89$
(7) $32.357 \div .397$
(8) $1722.2 \div 298$

79. *Suggestive Questions in Fractions.*

1. $4 \div 5 = ?$ $5 \div 8 = ?$ Which number becomes the numerator? Which the denominator?

2. The line separating the numerator from the denominator is a sign of what process? Illustrate.

3. Express the fraction $\frac{3}{8}$ as an example in division. Do the same with the fraction $\frac{8}{3}$.

4. Draw an oblong 3 × 8 and divide it into 24 equal parts. Nine of the squares is what part of the whole? (Two answers.) Sixteen of the squares is what part of the whole? (Two answers.)

5. Multiply 8 by 6. Sixteen is what part of the product? twelve is what part ?

6. When an article is sold at a gain of $\frac{1}{3}$, the selling price is what part of the cost? If sold at a loss of $\frac{1}{3}$?

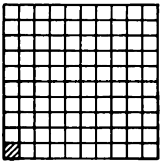
80.* *Percentage — Introduction.*

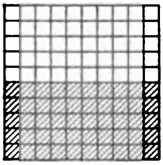
1. *For study.* At the end of the term a class was asked to spell 100 words.

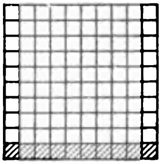
a. Charles spelled 98 words correctly. How many hundredths (or what per cent) of the words did he spell correctly?

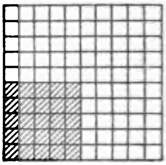
b. Evelyn missed 6 words. How many hundredths (or what per cent) of the words did she miss?

> "Per cent" is from two Latin words meaning "by the hundred." The sign % means per cent. 25 % = 25 per cent = .25.


1 per cent


50 per cent


10 per cent


25 per cent

2. $1 = \frac{?}{4};\ \frac{?}{7};\ \frac{?}{38};\ \frac{?}{100};$? per cent of the number.

3. Draw a rectangle $2\frac{1}{2}$ inches square and subdivide it into 100 smaller squares. Show by shading:

a. 2 %   *b.* 5 %   *c.* 75 %   *d.* 9 %

4. A stock dealer having a herd of 200 cattle sold 25 % of them. How many of them did he sell?

Analysis by Decimals	Analysis by Percentage
1.00 of herd = 200 cattle	100 % of herd = 200 cattle
.01 of herd = 200 cattle ÷ 100	1 % of herd = 200 cattle ÷ 100
= 2 cattle	= 2 cattle
.25 of herd = 25 × 2 cattle	25 % of herd = 25 × 2 cattle
= 50 cattle	= 50 cattle

He sold 50 cattle from the herd.

Note that the two solutions are identical except that the sign % replaces the decimal point.

Give analysis:

5. A paper contains 100 pins. If I take out 20 %, how many pins do I take out? What % do I leave?

6. A real estate agent sold a house for $2000 and received a commission of 5 %. Amount of his commission?

7. I bought an automobile for $1200 and sold it at a loss of 10 %. For what did I sell it?

8. Some flour was damaged 25 % in transportation. If 800 barrels were sent, how many barrels arrived in good condition?

9. Mr. Allen had $750 deposited in two banks. If 20 % of his money was in the first bank, how much had he deposited in the second bank?

10. A butcher bought 30 lb. of live chickens. How much did they weigh when dressed, if the loss was 20 %?

11. One week Walter made $3.20 by selling papers. How much did he make the next week, if his earnings increased 20 %?

12. Mr. Spencer borrowed $200 for one year. At the end of the time he paid 5 % interest for the use of the money. How much interest did he pay?

13. The population of a certain town three years ago was 6000. If it has increased 25 %, what is the present population?

81. *Express as decimals:*

1. 7 %
96 %

2. 5 %
78 %

3. 6 %
17 %

4. 2 %
20 %

82. *Express as per cent:*

1. .46
.03

2. .69
.83

3. .07
.96

4. .87
.06

83. *What per cent equals:*

1. $\frac{1}{2}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{1}{5}$; $\frac{2}{5}$?

2. $\frac{3}{5}$; $\frac{4}{5}$; $\frac{1}{10}$; $\frac{1}{20}$; $\frac{3}{10}$; $\frac{3}{20}$?

84. *Solve by cancellation:*

1. $2\frac{3}{4} \times 4\frac{2}{7} \times 2\frac{7}{9} \times 1\frac{1}{11} \times 2\frac{1}{10} = ?$
2. $3\frac{3}{8} \times 2\frac{2}{3} \times \frac{1}{42} \times 6\frac{2}{5} \times 5\frac{5}{6} = ?$
3. $\frac{1}{9} \times 2\frac{1}{7} \times \frac{6}{11} \times 1\frac{10}{12} \times 4\frac{1}{5} = ?$
4. $2\frac{1}{3} \times 1\frac{4}{35} \times 20\frac{5}{6} \times \frac{7}{65} \times \frac{1}{5} = ?$
5. $\frac{5}{9} \times 2\frac{43}{91} \times \frac{13}{15} \times 16\frac{1}{5} \times 12\frac{3}{5} = ?$

85. *Change to decimals and per cent:*

1. $\frac{1}{2}$
2. $\frac{7}{10}$
3. $\frac{1}{5}$
4. $\frac{1}{4}$
5. $\frac{2}{5}$
6. $\frac{2}{4}$
7. $\frac{3}{5}$
8. $\frac{3}{4}$
9. $\frac{1}{20}$
10. $\frac{4}{5}$
11. $\frac{1}{25}$
12. $\frac{3}{20}$

86. *At sight:*

1. $\frac{1}{8} + \frac{2}{7}$
2. $\frac{7}{8} \times \frac{2}{3}$
3. 10×2.5
4. $\frac{5}{6} - \frac{3}{4}$
5. $7.2 + 20$
6. $\frac{3}{5} + \frac{1}{3}$
7. $.7 + 1.04$
8. $\frac{6}{7} + \frac{1}{14}$
9. $2.1 - .21$
10. $\frac{5}{6} \div \frac{5}{7}$
11. $\frac{4}{7} \times \frac{1}{4}$
12. $\frac{3}{4} - \frac{5}{8}$
13. $.25 - .025$
14. $\frac{1}{6} + \frac{3}{8}$
15. $\frac{4}{9} \times \frac{2}{5}$

87. *Express as decimals and fractions:*

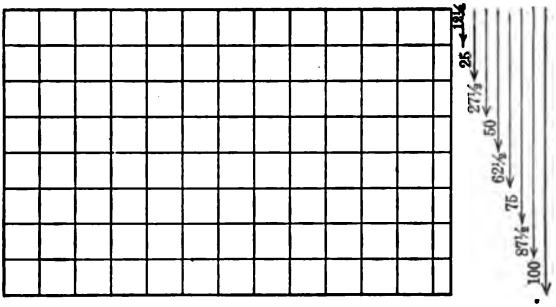
1. 8 %
2. 75 %
3. 5 %
4. 65 %
5. 68 %
6. 55 %
7. 20 %
8. 50 %
9. 95 %
10. 82 %
11. 15 %
12. 36 %
13. 25 %
14. 6 %
15. 14 %
16. 35 %
17. 56 %
18. 85 %
19. 80 %
20. 18 %
21. 26 %
22. 45 %
23. 92 %
24. 76 %

88. *Find the quotient:*

1. 75,680 ÷ 27.9
2. 23.94 ÷ .269
3. 296.28 ÷ 2.87
4. 229.31 ÷ 18.6
5. 40,210.8 ÷ 34.5
6. 64.376 ÷ 1.97
7. 9025.5 ÷ 179
8. 233.59 ÷ 26.9

89. *Aliquot Parts — continued.*

See previous lesson, p. 234.



1. This diagram is equal to how many complete squares? One line equals how many squares?

2. *Complete and learn:*

$\frac{1}{8}$ of 100 = ?
$\frac{2}{8}$ of 100 = ?
$\frac{3}{8}$ of 100 = ?
$\frac{4}{8}$ of 100 = ?
$\frac{5}{8}$ of 100 = ?
$\frac{6}{8}$ of 100 = ?
$\frac{7}{8}$ of 100 = ?
$\frac{8}{8}$ of 100 = ?

3. What is the cost of 5 lb. of butter at 62½¢ (\$$\frac{5}{8}$) a pound?

4. What will I pay for 3 dozen cans of tomatoes at 12½¢ a can?

5. In an orchard of 240 trees, 37½ % were apple. How many apple trees were there?

6. In a school of 400 pupils, 62½ % were girls. How many girls were in the school?

7. *At sight:*

a. 16 × 37½
24 × 62½
32 × 87½
40 × 12½

b. 8 × 62½
64 × 87½
72 × 37½
56 × 12½

c. 56 × 37½
40 × 62½
96 × 12½
8 × 87½

90.* *Finding what Decimal Part One Number is of Another.*

1. *For study.* Grace solved 7 of the 9 problems in today's lesson. What decimal part of the lesson has she mastered?

Analysis	Write
9 problems = $\frac{9}{9}$ of the lesson	7 problems = $\frac{7}{9}$ or .77+ of the lesson
1 problem = $\frac{1}{9}$ of the lesson	Grace has mastered .77+ of the lesson
7 problems = $\frac{7}{9}$ or .77+ of the lesson	

2. Mr. Wilson earns $50 a week. His son Claude earns $30 a week. Claude's earnings are what decimal part of his father's?

3. Hubert is in school 5 hours in a day. What decimal part of the day is he in school?

4. A boy has delivered papers to 100 of his customers. He still has 25 papers to deliver. What decimal part of his papers has he delivered?

91. *Find the difference between:*

1. One million eight thousand ten and eight thousandths; and ninety-nine thousand seventy-nine and nine thousand six ten-thousandths.

2. Seventy-two thousand eight and one hundredth; and seven hundred ninety-eight and eighty-nine ten-thousandths.

3. Three million six hundred thousand seventy-two and fifty-six hundredths; and nine hundred sixty-nine thousand two hundred five and fifty-six thousandths.

4. Seven hundred thousand seven hundred and seven hundredths; and nine thousand nine and nine thousandths.

92. *Add:*

1. 27.6 + 5.24 + 42.78 + .031 + 169.3
2. 84.4 + .875 + 7.95 + 18.56 + 637.8
3. 63.3 + 8.57 + .876 + 29.85 + 695.4
4. 56.7 + 4.09 + .468 + 67.49 + 820.9

93. *Written Problems.*

1. Make out and receipt a bill to F. D. Spencer in account with S. L. Wasson & Co. for $\frac{1}{2}$ yard silk @ $1.75; $\frac{3}{4}$ yard silk @ $2.25; 7$\frac{1}{2}$ yards velvet @ $3.50.

Make sure that the pupils understand that an extra half-cent is charged when the cost amounts to a half-cent or more.

2. *a.* 56 is what fractional part of 64?
b. 56 is what decimal part of 64?

3. What change should a housekeeper receive from a five-dollar bill after making the following purchases: two ten-pound sacks of flour at 70 cents; three pecks of potatoes at 60 cents; 2 lb. of onions at 8 cents a pound; 2 dozen eggs at 57 cents a dozen?

4. Which is greater, 1.567 or 1$\frac{21}{40}$? How much greater?

5. A farmer raised 108 bushels of clover seed. He sold 62$\frac{1}{2}$ % of the seed. How many bushels did he keep?

6.† Galileo discovered that the earth moved during one year about 567 millions of miles in its circuit around the sun. He further calculated how many miles it traveled in one day. What was his result?

7. Mr. Evans owned $\frac{3}{5}$ of a book store and sold .4 of his share for $9600. At this rate what was the value of the store?

8. A 200-acre farm is sowed in grain as follows: $\frac{1}{4}$ in rye, $\frac{1}{6}$ in oats and $\frac{1}{8}$ in wheat. The rest is pasture. How much is pasture?

9. Draw a rectangle 3 inches wide and 4 inches long. Show 75 % of it.

10. In an orchard there are 120 trees: 40 of them are pear trees, 30 are apple trees and the rest are plum trees. What decimal part of the whole number of trees are pear? Are apple? Are plum?

11. A shop-worn football which had cost $3.60 was sold at 10 % discount. What was the selling price?

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† See Table of Contents.

12. A lady having an income of \$1840 a year saves 25% of it. How much does she spend during the year?

13. Find the value of a field 120 rods long and 80 rods wide at \$140 an acre.

14. A Washington street merchant bought 2000 lb. of sugar for \$170 and sold $\frac{3}{5}$ of it at the rate of 10 lb. for \$1 and the remainder at $9\frac{3}{4}$ cents per lb. What was his gain?

15. One of our city parks contains 18 acres. Four men are employed to cut the grass. One man cuts $\frac{1}{4}$, another $\frac{2}{9}$ and the third $\frac{5}{12}$ of the whole. How many acres does the fourth man cut?

16. A school can buy blank books of one dealer at the rate of \$3.25 a hundred and of another at \$4.32 per gross. Which offer is the better and how much?

17. Multiply 1 ten-thousandth by 1 million and subtract one hundred-thousandth from the product.

18. How much shall I gain on 12 barrels of flour, if I buy 250 barrels for \$2500 and sell at a gain of 20%?

19. A grocer advertises the following prices:

Cheese	50 cents per lb.
Eggs	60 cents per doz.
Grapes, Malaga	25 cents per lb.
Apples, cooking	\$6.50 per bbl.

Make out a bill for the following articles purchased by you from Mr. R. H. May, on Jan. 2, 1917: $6\frac{1}{4}$ lb. cheese, $5\frac{1}{3}$ doz. eggs, $\frac{1}{2}$ bbl. of apples, $5\frac{1}{4}$ lb. grapes.

20. Divide seven and seven-tenths by one hundredth; to the quotient add one thousandth; multiply this sum by one hundred and subtract one ten-thousandth from the product.

94. *Oral Exercises.*

1. How many $\frac{1}{2}$-inch squares can you draw in a 4-inch square?

2. At the rate of 3 for 5 cents, what will 48 apples cost?

3. Which is larger, a three-inch square or three square inches? How much?

4. When $\frac{1}{2}$ of a farm exceeds $\frac{1}{3}$ of it by 40 acres, how many acres in the farm?

5. How many dozen eggs are there in a box containing 100 eggs?

6. At $3.20 a gallon what will 3 pints of oysters cost?

7. Alice attended school 18 of the 22 school days in November. What decimal part of the school days was she absent?

8. Find the cost of 8 brooms at $9 per dozen.

9. A grocer bought one lot of potatoes at $1.80 a bushel and an equal lot at $1.65 a bushel. He sold them at $1.70. Did he gain or lose and how much per bushel?

10. Frank picked $\frac{1}{4}$ of a bushel of berries. He sold $\frac{1}{2}$ of the lot to one man and $\frac{1}{4}$ of the remainder to another. How many quarts remained?

11. $\frac{1}{8}$ of 64 equals $\frac{2}{3}$ of what number?

12. If $3\frac{1}{2}$ tons of coal cost $28, what will $10\frac{1}{2}$ tons cost?

13. How many square paving stones 3 feet long will it take to cover a surface 27 feet long and 12 feet wide?

14. Mr. Cross fenced his strawberry patch which was 2 rods wide and 100 feet long. How many feet of fencing did he use?

15. What is the length of all the edges of a 4-foot cube?

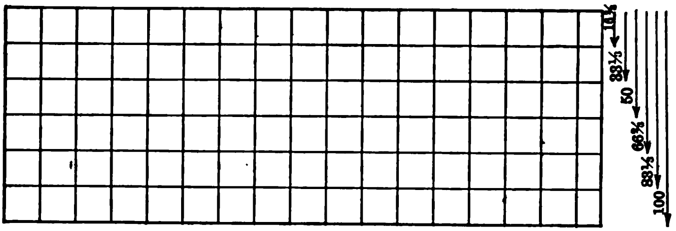
16. Mr. Ray tests 40 kernels of corn to see how many will grow. Of these 15 fail to grow. What decimal part of the whole number of kernels grew?

17. Find the cost of 2500 bricks at $12 per thousand.

18. A man bought 12 tons of coal in August at $8.50 per ton. The winter price was $9.75. How much did he save by buying in the summer?

95. *Aliquot Parts — continued.*

See previous lessons, pp. 234, 239.



1. This diagram is equal to how many complete squares? One line equals how many squares?

2. Complete and learn:

$\frac{1}{6}$ of 100 = ?
$\frac{1}{3}$ of 100 = ?
$\frac{1}{2}$ of 100 = ?

$\frac{2}{3}$ of 100 = ?
$\frac{5}{6}$ of 100 = ?
$\frac{6}{6}$ of 100 = ?

3. What is the cost of 5 yards of ribbon at $16\frac{2}{3}$ cents a yard?

4. What will I pay for 2 pairs of hose at $33\frac{1}{3}$ cents a pair?

5. It rained on $83\frac{1}{3}\%$ of the days in April. How many days did it rain?

6. In a crate of 240 eggs, $16\frac{2}{3}\%$ were broken. What per cent of the eggs were broken? How many eggs were broken?

7. If $33\frac{1}{3}\%$ of the trees in an orchard of 450 trees were peach trees and the rest apple, how many apple trees were there?

8. At sight:

a. $18 \times 16\frac{2}{3}$
$9 \times 33\frac{1}{3}$
$12 \times 83\frac{1}{3}$
$15 \times 66\frac{2}{3}$

b. $21 \times 33\frac{1}{3}$
$24 \times 16\frac{2}{3}$
$30 \times 83\frac{1}{3}$
$27 \times 66\frac{2}{3}$

c. $42 \times 16\frac{2}{3}$
$48 \times 83\frac{1}{3}$
$12 \times 66\frac{2}{3}$
$33 \times 33\frac{1}{3}$

96.* *Cubic Measure.*

1. How many chocolate caramels (inch-cubes) will exactly fill a box 4 inches wide, 9 inches long and 3 inches high? Prove your result by using wooden inch-cubes.

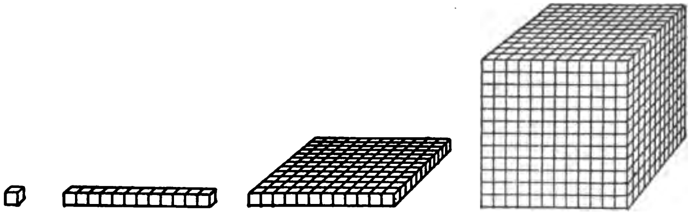
2. Measure the length, width and height of your school room. Class exercise.

a. How many cubic feet are there in a strip as long as your room, 1 foot wide and 1 foot high?

b. How many cubic feet in a layer the length of the room, the width of the room and 1 foot high?

c. How many cubic feet in the whole room?

3. The large figure below represents one cubic foot. How many cubic inches does it contain?



4. How many cubic feet of earth must be removed to make a cellar 24 feet long, 18 feet wide and 9 feet deep?

5. It is calculated that a living room with windows on two sides, to be heated by hot-water radiators, should have one square foot of radiating surface to every thirty cubic feet of air. How many square feet of radiation must you have for a room 30 feet × 18 feet × 9 feet?

Cubic Measure

From your knowledge of linear measure, complete and learn:

—— cubic inches make 1 cubic foot.
—— cubic feet make 1 cubic yard.

97. *A Town Library — Oral.*

1. A wealthy citizen gave $50,000 for the building on condition that the citizens pay annually 10 % of the cost of the building for the maintenance of the library. The town council gladly voted $—— for this purpose.

2. The librarian's salary was 60 % of the amount voted by the town council. She received $——. What per cent of the amount voted by the council went for other purposes?

3. The library opened a year ago with 5000 volumes. To-day there are 125 % of that number of books in the library. How many books have been added?

4. Find the number of books issued each day. Calculate upon Monday's circulation.

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
Story Books	50	110 %	90 %	60 %	50 %	300 %
Poems	24	25 %	50 %	$33\frac{1}{3}$ %	$66\frac{2}{3}$ %	100 %
Biography	9	100 %	200 %	0 %	$33\frac{1}{3}$ %	300 %
Travel	6	$66\frac{2}{3}$ %	50 %	$116\frac{2}{3}$ %	$33\frac{1}{3}$ %	250 %
History	8	$112\frac{1}{2}$ %	25 %	$62\frac{1}{2}$ %	$37\frac{1}{2}$ %	300 %
Miscellaneous	25	60 %	120 %	80 %	40 %	140 %

98. *In the Children's Room.*

William: Good morning! I have found three interesting looking books: *Robin Hood, Tom Sawyer* and *Captains Courageous.* Which is the best?

Librarian: I will look up my records. *Robin Hood* was called for 60 times last year; *Captains Courageous,* 45 times or (? %) of that number; and *Tom Sawyer,* 75 times or (? %) of that number.

William: Thank you. That gives *Tom Sawyer* the lead (by ? per cent). I'll take that book first.

Librarian: You may keep it 14 days. To-day is June 19, so you must return it on or before ——.

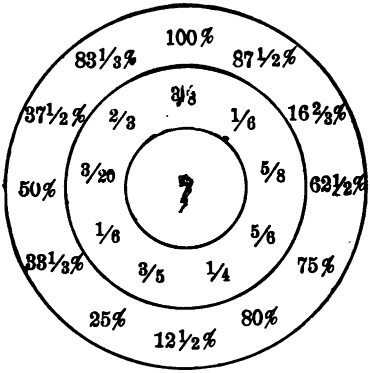
William: Oh! It has only 256 pages and I can easily read 80 pages a day in vacation. I will return the book ——.

Librarian: You will be surprised to know that last month I collected $1.98 in fines at 3 cents a day. How many days' fines were collected?

William: I hope that none of the fines was collected from the pupils in our school. We have 40 pupils and of these 35 (? %) read on an average 2 library books each month. In all, the pupils in our school read —— books each month.

Where practicable take the class to a neighboring library where the pupils can get data from which to formulate their own problems.

99. *For rapid practice:*



The teacher will copy this diagram upon the blackboard and use daily for practice until the response becomes automatic. When the teacher points to a fraction the pupil should give the equivalent per cent and vice versa. Put special emphasis upon the more difficult fractions, as $\frac{3}{8}$ and $\frac{5}{6}$.

100. *Written Dictation.*

1. Indiana celebrated its centennial in the year MCMXVI. (Teacher write upon the board.) How long ago was that?

2. $62\frac{1}{2}\%$ of anything is what fractional part of it?

3. A scarlet rambler had 500 blooms and 75% as many buds. How many buds on the rambler?

4. If 24 men can finish a piece of work in 8 days, how long will it take 3 men?

5. At $\$\frac{3}{4}$ a yard how much silk can I buy for $\$\frac{1}{2}$?

101. *Subtract:*

1. $\begin{array}{r}4231\frac{2}{9}\\ \underline{2765\frac{7}{8}}\end{array}$	**3.** $\begin{array}{r}5131\frac{3}{5}\\ \underline{4967\frac{5}{7}}\end{array}$	**5.** $\begin{array}{r}8013\frac{5}{9}\\ \underline{4897\frac{6}{7}}\end{array}$	**7.** $\begin{array}{r}9764\frac{5}{6}\\ \underline{8869\frac{6}{7}}\end{array}$
2. $\begin{array}{r}6798\frac{5}{8}\\ \underline{4869\frac{3}{4}}\end{array}$	**4.** $\begin{array}{r}9658\frac{6}{7}\\ \underline{7986\frac{7}{8}}\end{array}$	**6.** $\begin{array}{r}8500\frac{3}{7}\\ \underline{6979\frac{2}{3}}\end{array}$	**8.** $\begin{array}{r}9768\frac{1}{3}\\ \underline{7864\frac{5}{8}}\end{array}$

102. *Elizabeth's Birthday.*

1. Elizabeth Smith was twelve years old on last Christmas day. Write in Roman numerals the year in which she was born. As she enters the seventh grade at the beginning of the next term, in what year will she graduate from high school if she is promoted each term?

2. Elizabeth's mother refurnished her bedroom as a birthday gift. She put fresh matting on the floor which was 12 feet wide and 18 feet long. If the matting cost 65 cents a yard and was a yard wide, how much did it cost?

3. She bought of Jenkins & Jason two grass rugs at $3.25, 3 pairs of muslin curtains at $2.25, a half-dozen towels at 37½ cents each. Make and receipt the bill for these items.

4. The dresser cost $18, which was ⅗ of the cost of the bed. How much did both cost?

5. Elizabeth's father gave her a swimming outfit. The ticket for the course of ten lessons was $2.50; her suit cost 90 % as much. If Elizabeth takes all the lessons, how much will the entire cost be including two car tickets (at 25 for $1.00) for each lesson?

6. On the day before Christmas, Elizabeth went to her grandmother's to decorate the tree and the third-floor room in which it was placed. She worked from 10:35 A.M. until 1:25 P.M. How long did she work, if she stopped 30 minutes at noon?

7. The room is 40 feet long and 20 feet wide. How many yards of Christmas greens did she use in festooning a single rope of cedar around the walls, allowing 25 % of the distance around the room for draping?

8. The tree cost $1.25 which was 25 % of the cost of the trimmings. How much did both cost?

9. Grandmother had bought the 12-pound turkey directly from a farmer and had paid 35 cents a pound for it. If she had bought it on market it would have cost her $4.80. How much did she save?

10. At the dinner table everybody had to tell how old he was.

a. Elizabeth's age was $33\frac{1}{3}\%$ of her father's age. (See Problem 1.)
b. Her father's age was 50% of her grandmother's age.
c. Her father's age was $112\frac{1}{2}\%$ of her mother's age.
d. Bob's age was $66\frac{2}{3}\%$ of Elizabeth's.
e. Little Jane's age was $16\frac{2}{3}\%$ of father's age. How old was each?

11. Make an original problem which will require the use of percentage concerning this Christmas party. Perhaps you are a cousin who comes in later in the afternoon.

103. *At sight:*

1. $2.89 \div 17$
$28.9 \div 1.7$
$.289 \div .17$
$2.89 \div .17$
$289 \div 1.7$

2. $22.5 \div 1.5$
$.225 \div .15$
$2.25 \div 15$
$225 \div .15$
$22.5 \div .15$

3. $3.24 \div 18$
$32.4 \div 1.8$
$324 \div .18$
$.324 \div 1.8$
$3.24 \div .18$

104. *Reduce to equivalent fractions:* (*rapid practice*)

1. 120%
2. $12\frac{1}{2}\%$
3. 15%
4. $16\frac{2}{3}\%$
5. 5%
6. $37\frac{1}{2}\%$
7. 35%
8. $33\frac{1}{3}\%$
9. 25%
10. $62\frac{1}{2}\%$
11. 45%
12. 50%
13. 4%
14. 75%
15. $66\frac{2}{3}\%$
16. 55%

105. *Reduce to decimals, carrying none farther than three places:*

1. $\frac{7}{16}$
2. $\frac{3}{16}$
3. $\frac{12}{25}$
4. $\frac{5}{24}$
5. $\frac{5}{18}$
6. $\frac{7}{20}$
7. $\frac{6}{25}$
8. $\frac{25}{36}$
9. $\frac{4}{7}$
10. $\frac{11}{12}$
11. $\frac{19}{30}$
12. $\frac{8}{25}$
13. $\frac{5}{12}$
14. $\frac{15}{16}$
15. $\frac{7}{32}$
16. $\frac{29}{32}$
17. $\frac{8}{9}$
18. $\frac{5}{16}$
19. $\frac{21}{32}$
20. $\frac{27}{40}$

How many yards can be bought for:

1. \$2.50 @ 75¢ a yd.? 75 2.50
2. \$6.25 @ $12\frac{1}{2}$¢ a yd.?
3. \$5.00 @ $62\frac{1}{2}$¢ a yd.?
4. \$2.50 @ $16\frac{2}{3}$¢ a yd.?
5. \$5.00 @ 25¢ a yd.?
6. \$7.50 @ $33\frac{1}{3}$¢ a yd.?
7. \$1.25 @ $6\frac{1}{4}$¢ a yd?.
8. \$1.50 @ $8\frac{1}{3}$¢ a yd.?
9. \$2.50 @ $37\frac{1}{2}$¢ a yd.?
10. \$5.25 @ \$1.25 a yd.?
11. \$10.00 @ \$$1.33\frac{1}{3}$¢ a yd.?
12. \$7.75 @ $83\frac{1}{3}$¢ a yd.?

106. *At sight: a.* Give fractional parts. *b.* Give per cents.

1. 4 of 5.
2. 4 of 6.
3. 4 of 8.
4. 4 of 10.
5. 6 of 8.
6. 6 of 10.
7. 6 of 15.
8. 6 of 18.
9. 7 of 14.
10. 7 of 21.
11. 7 of 28.
12. 7 of 35.
13. 8 of 4.
14. 8 of 6.
15. 8 of 10.
16. 8 of 12.

107. *Add:*

1.	2.	3.	4.	5.	6.
796	997	928	688	978	778
877	789	799	398	654	396
686	857	689	978	488	576
999	978	386	988	998	869
927	896	976	966	699	589
647	898	968	458	499	889
789	697	579	769	767	977
986	969	999	757	288	479
789	569	787	668	989	569
788	989	878	597	689	989

108. *Written Problems.*

1. James Porter wishes to cover the floor of a room in his summer cottage with Japanese matting a yard in width. What will it cost him at 60 cents a yard, if the room is 12 × 15 feet?

2. A grocer had 50 bu. 2 pk. of apples and sold $36\frac{3}{4}$ bu. at $3 per bu. Find the number of bushels remaining and the amount received for apples sold.

3. How much did Mr. Carroll pay for the following:

50 lb. fine cream candy @ 75¢
60 lb. peanut butter @ 29¢
10 lb. mixed candy @ 40¢
5 doz. boxes caramels @ 75¢ a box.

4. Bought pencils at $3 per gross and sold them at 60¢ per dozen. How much was the gain or loss?

5. At 15 cents a pint how much will 2 gal. 3 qt. of blackberries cost?

6. Assuming that a city block is $\frac{1}{8}$ of a mile, how far does a boy who lives 6 blocks from the school walk in attending school one week, if he goes home for lunch?

7. How many 9-inch square tiles will cover a floor 12 ft. by 27 ft.?

8. If each child in a schoolroom should have 250 cu. ft. of air space, how many children may sit in a room 35 ft. long, 25 ft. wide and 12 ft. high?

9. State what is given and what is required in the following problem, without solving it. How much does it cost at $2.15 per square yard to cement the floor of a porch 21.5 ft. wide and 29.5 ft. long?

10. A floor 30 ft. long and 18 ft. wide is to be covered with carpet a yard wide. How many yards are needed?

11. Make out and receipt a bill to E. S. Woodstock in account with Insley Bros. for:

1 overcoat @ $45.50
1 rug @ $35.
7 yd. dress goods @ $1.75
$3\frac{1}{2}$ yd. silk @ $2.

12. A cellar 31 ft. long and 18 ft. wide had water in it to the height of 5 ft. How many cubic feet of water were in the cellar?

13. I intend to spend 60 % of the money that I have saved for repairing my house and then I shall have $225 left. What will the repairs cost me?

14. If three yards of ribbon cost 25 cents, how many yards can be bought for $3? Ratio.

15. What will it cost to buy a farm $\frac{1}{2}$ of a mile long and 80 rods wide at $150 an acre?

16. A man buys 6 chests of tea, each weighing 400 lb., for $1440, and sells it at 70 cents per pound. How much does he gain?

17. Compare a quart with a gallon; a quart with a peck. Express your answers as common fractions, as decimals and as per cents.

18. A dealer asked a farmer $75 for a wagon, but sold it to him at 10 % less, for cash. The amount the farmer paid for the wagon was equal to $\frac{1}{2}$ of the cost of the horse. How much did both cost him?

19. A dealer bought 58 tons of coal at $6.50 a ton. He sold $\frac{1}{2}$ of it at $8.50 a ton and the balance for $245.50. How much did he gain on the whole?

20. A draftsman worked for $.50 per hour. If he works 44 hours per week and his expenses are 70 % of his salary how much can he save in one week?

21. Mr. Prince bought a house and lot for $5700. He paid for repairs to the carpenter $248, to the mason $76, to the plumber $169, to the paper hanger $83, to the painter $360, and for sundries $90. How much cheaper would another property in good repair have been at its price of $6500?

22. James White, representing a base ball nine, bought of Brown & Co., 4 in-fielder's gloves at $4.50, 2 balls at $2.40, 7 bats at 65¢, and a catcher's outfit costing $8.25. Make and receipt the bill.

23. A newsboy buys papers at the rate of 4 for 5¢, and sells them for 2¢ each. How many will he have to sell to make $2.40?

24. Find the cost of painting the walls and ceiling of a room 14 ft. long, 12 ft. wide and $9\frac{1}{2}$ ft. high at 40 cents per square yard.

25. A family uses 2 quarts of milk a day. At 60¢ a gallon, what is the cost of the milk for May and June?

26. A house was rented for $48 a month. The yearly rent was 10% of the value of the house. What was its value?

27. A farmer sold his land, which cost $7200, at $12\frac{1}{2}$ per cent gain. A year before he might have sold at a gain of $1000, but refused to sell. How much did he lose by waiting?

28. A man made a canvas canoe, the material of which cost $22. The work required 24 hours of his time. He then sold the canoe for $40. What was his profit? What was his labor worth an hour?

29. A grocer buys tea at $.75; how much must he charge per pound that he may gain 20 per cent?

30. At $1.60 a copy, find the cost of $2\frac{1}{2}$ dozen copies of *Snow Bound*. What price must the dealer receive for the entire lot if he sells at a gain of $12\frac{1}{2}$ per cent?

31. *a.* 25 is what per cent of $12\frac{1}{2}$?

b. $12\frac{1}{2}$ is what per cent of 75?

32. A clerk whose salary is $1600 a year, resolves to live on $62\frac{1}{2}$% of it. If he succeeds, how much money will he save?

33. A tract of land containing 67 acres is laid out in city lots. If 20 per cent of the land is occupied by streets and alleys, how many lots, each containing $\frac{1}{5}$ of an acre, will there be?

34. An Illinois farmer raised 250 bushels of potatoes per acre on $8\frac{3}{5}$ acres. He sold $\frac{1}{10}$ of them at $1.80 per bu., $\frac{3}{8}$ at $1.60 per bu. and the remainder at $2.10 per bu. What was the entire crop worth?

Test Page I

This page and the one following contain types of exercises which the class should do readily before proceeding to more difficult work. A class percentage of not less than eighty should be required.

These pages can also be used for classes about to take up the work of the first section of the Advanced Book.

I

Write answers only:

1. $\frac{5}{6}$ of anything is what per cent of it?

2. $7.5 \div 1.5 = ?$

3. A chimney measuring 160 feet from the bottom of its foundation to its top is $87\frac{1}{2}\%$ above the ground. How high is it above the ground?

4. 24 is what decimal part of 36?

5. A man divided his property among his 3 children, giving $37\frac{1}{2}\%$ of it to the first, 25 % to the second and the remainder to the third. What part did the third child receive?

II

Show all work — time limit 25 *minutes:*

1. A man who earned $1600 spent 84 % of it one year. How much did he save?

2. An acre of land produced 18,756 lb. of sugar beets. How many pounds of sugar did these beets contain, if a test showed them to be $16\frac{2}{3}\%$ sugar?

3. If a hog gains $13\frac{1}{2}$ pounds for each bushel of wheat fed, how many bushels of wheat are needed to increase the hog's weight from $225\frac{3}{4}$ pounds to $397\frac{7}{8}$ pounds?

4. If 26 pounds of cream produced 6 pounds of butter fat, what part of the cream was butter fat?

5. How many square yards are there in a floor 15 feet wide and 18 feet long?

Test Page II

III

Oral Problems

Before solving, name the operation to be used in the problem.

1. A farmer sold 2 loads of hay. The first weighed 1.17 tons and the second 1.24 tons. What was their total weight?

2. 12 is what decimal part of 72?

3. If my watch gains $\frac{1}{6}$ of a minute in 1 day, in how many days does it gain $1\frac{1}{3}$ minutes?

4. A football player ran $\frac{3}{5}$ of the length of the field. If he ran 60 yards, how long was the field?

5. Richard misspelled 4 % of the 50 words in his spelling lesson. How many words did he spell correctly?

IV

Write at dictation:

1. Add: 9367 + 8868 + 7998 + 8876 + 6669 + 5998 + 9747 + 6959. (~~Two minutes~~)

2. Find the difference between: 604.0906 and 206.10386 (~~Two minutes~~)

3. Multiply 690.78 by 7.098. (~~Three minutes~~)

4. Divide 6603.164 by .894. (~~Three minutes~~)

5. Multiply $876\frac{5}{6}$ by 79. (~~Two minutes~~)

V

Each child one exercise: (oral)

1. 6 % of $200
1.2 × .9
$\frac{2}{3} \div \frac{3}{4}$
.96 ÷ .16
6 ÷ 24 = ?

2. 7.2 ÷ 1.8
8 % of $150
1.7 × .6
$\frac{5}{6} \div \frac{2}{5}$
3 ÷ 15 = ?

3. 1.5 × .06
$\frac{6}{7} \div \frac{1}{2}$
4 % of $125
.85 ÷ 1.7
4 ÷ 18 = ?

7766

776
6
5256
5
5261

52679
47349
5?61

SUGGESTIONS TO TEACHERS

1. Read the Preface and the Table of Contents.

2. Make haste slowly. See that each day's lesson averages about 80% perfect for class work. Note weaknesses, explain and follow with similar work the next day.

3. Introduce new ideas inductively and through situations that are vitally interesting to the child. This can best be done by a generous use of dramatization. In dramatization throw the burden of suggestion upon the pupils. The ingenuity fostered when children transform schoolroom furniture or construct at home playthings for school use is of inestimable value to them. Moreover, the lesson thought out by twenty-five minds is far richer in suggestive material than one which only the teacher plans. Insist on play *for the sake of number* — not for mere amusement. Require the utmost courtesy at all times.

4. Follow concrete and objective presentation with systematic flash practice with the number symbols. Use large perception cards for this purpose. *Keep up this practice for short periods daily until the reaction is automatic. Then stop,* and go on to more difficult exercises. Do not go to the miscellaneous practice until the child knows his number tables in order, forward and backward. No concert work.

5. Lastly, apply the idea to new concrete situations.

Insist upon the strictest honesty in the preparation of papers. Class spirit will do more to check cheating than any device.

6. Encourage free, graphic illustration of concrete problems.

692
419
600
411519
3106
5561
1619

12

7. Teach the child to estimate answers before beginning to figure, and to use his common sense on all occasions. Give frequent exercises in which the pupils do nothing but estimate answers in round numbers, or in which they merely indicate the process by which the answer is to be obtained.

8. Put a premium on the original solution of a problem. Commend highly the child who has ingenuity enough to see two or more correct methods.

9. Periodically call for original problems from the class. When presented, have the pupils criticize them for interest, for probability, for test of thinking power, etc. Use the best problems. Two fertile fields for original problems are (*a*) life on the streets and in the home; (*b*) the geography, history or stories that the class is reading. Care should be taken not to violate good taste in reducing poetical symbolism to mathematics.

10. Endeavor so to stimulate the class that each pupil will strive to work out for himself the special study lessons marked *. These are so carefully graded that the pupil with average ability will have no difficulty.

11. Give quantities of oral work from the book. The pupils should learn that the result may be arrived at in different ways, and that while they wait for the slower members of the class to get the answers they have time to check.

12. Require pupils to check answers until they have acquired the habit.

13. Make accuracy the first requisite and speed the second.

14. Encourage each pupil to keep a record of his individual progress.

15. Teach pupils to help one another without telling the answer. Pupil teaching is in many ways the most vital of all.

16. Follow the order of the text-book and supplement it by exercises fitted to the needs of individual classes, no two of which are ever exactly alike.

17. Make success the keynote of the work.

HOW ONE RECITATION MIGHT BE CONDUCTED

Grade: Beginning Sixth. Time, 25 minutes.

PART I — 5 MINUTES

From the book and without pencil, Exercise 7, page 131, and Exercise 10, page 135. Or: on paper at teacher's dictation, an adaptation of Exercise 4, page 131.

PART II — 10 MINUTES

Study of arithmetic papers prepared alone by the pupils on the previous day. These papers have been graded by the teacher, who has made note of individual failures. The pupils now see their papers for the first time. Lesson assigned: Exercise 8, problems 1–4 on page 132.

The teacher announces that the class made 80 per cent on the papers, just the standard she is trying to maintain. This means not only that the pupils have worked earnestly but that she has gauged their power accurately.

Those pupils who have failed on the first problem should be asked to rise for help. The failures are of two types: (1) those not knowing the number of ounces in a pound, and (2) those who did not visualize the social background. Dramatize, using an actual pair of scales.

Those who failed on the second problem did not recognize Case II. Call for diagram and logical analysis. Mistakes in computation are less serious.

Those who failed on the third problem should dramatize.

Those who failed on the abstract example should be sent to the board and given new exercises until the teacher is satisfied that they understand. The rest of the class, at their seats, should figure with them for practice.

PART III — 10 MINUTES

Exercise 9 (1, 2, 3), page 134. On the previous day the teacher has told the pupils that they may come prepared to explain what they have studied out alone.

The written lesson assigned for the next day is page 132, Exercise 8, problems 5–9. Time 25 minutes.

Linear Measure

12 inches (in.)........=1 foot...........(ft.)
3 feet...............=1 yard..........(yd.)
5½ yards, or 16½ feet ..=1 rod...........(rd.)
40 rods...............=1 furlong ......(fur.)
320 rods, or 5280 feet ..=1 mile ....(mi.)
1 mi.=320 rd. =1760 yd. =5280 ft. =63,360 in.

Surveyors' Linear Measure

7.92 inches (in.)..... =1 link............(l.)
25 links............=1 rod...........(rd.)
100 links............=1 chain.........(ch.)
80 chains ....=1 mile......... (mi.)

Square Measure

144 square in. (sq.in.) ..=1 square foot (sq.ft.)
9 square feet (sq.ft.) .=1 square yard (sq.yd)
30¼ sq.yd., or 272¼ sq.ft.=1 square rod. (sq.rd.)
160 square rods........=1 acre...........(A.)
640 acres..............=1 square mile (sq.mi.)
1 A.=160 sq.rd. =4840 sq.yd. =43,560 sq.ft.

874
6
5364

Cubic Measure

1728 cubic inches (cu.in.)=1 cubic foot .(cu.ft.)
27 cubic feet..........=1 cubic yard. (cu.yd.)
128 cubic ft. ....=1 cord..........(cd.)
16 cubic feet ....=1 cord foot....(cd.ft.)
8 cord feet ....=1 cord..........(cd.)

Measure of Time

60 seconds (sec.)......=1 minute......(min.)
60 minutes ....=1 hour..........(hr.)
24 hours..............=1 day.......... (da.)
7 days ....=1 week ....(wk.)
365 days ....=1 common year. (yr.)
366 days ....=1 leap year

Dry Measure

2 pints .... =1 quart .... (qt.)
8 quarts .... =1 peck .... (pk.)
4 pecks .... =1 bushel .... (bu.)

Liquid Measure

4 gills .... =1 pint .... (pt.)
2 pints .... =1 quart .... (qt.)
4 quarts .... =1 gallon .... (gal.)
31½ gallons .... =1 barrel .... (bbl.)
~~63 gallons .... =1 hogshead ...... (hhd.)~~

Avoirdupois Weight

16 ounces (oz.) .... =1 pound .... (℔)
100 pounds .... =1 hundredweight (cwt.)
2000 pounds .... =1 ton .... (T.)
One pound Avoirdupois = 7000 grains

Troy Weight

24 grains (gr.) .... =1 pennyweight ... (pwt.)
20 pennyweights .... =1 ounce .... (oz.)
12 ounces .... =1 pound .... (lb.)
One Pound Troy = 5760 grains

Apothecaries' Weight

60 grains (gr.) .... =1 dram .... (dr. or ʒ)
8 drams .... =1 ounce ...... (oz. or ℥)
12 ounces .... =1 pound ...... (lb. or ℔)
One Pound Apothecaries' weight = 5760 grains

Apothecaries' Liquid Measure

60 minims (m.) .... =1 fluid dram .... (ʒ)
8 fluid drams .... =1 fluid ounce .... (℥)
16 fluid ounces .... =1 pint ..... (fl. oz. or O)
8 pints .... =1 gallon .... (cong.)

1 × 1 = 1	1 × 2 = 2	1 × 3 = 3	1 × 4 = 4
2 × 1 = 2	2 × 2 = 4	2 × 3 = 6	2 × 4 = 8
3 × 1 = 3	3 × 2 = 6	3 × 3 = 9	3 × 4 = 12
4 × 1 = 4	4 × 2 = 8	4 × 3 = 12	4 × 4 = 16
5 × 1 = 5	5 × 2 = 10	5 × 3 = 15	5 × 4 = 20
6 × 1 = 6	6 × 2 = 12	6 × 3 = 18	6 × 4 = 24
7 × 1 = 7	7 × 2 = 14	7 × 3 = 21	7 × 4 = 28
8 × 1 = 8	8 × 2 = 16	8 × 3 = 24	8 × 4 = 32
9 × 1 = 9	9 × 2 = 18	9 × 3 = 27	9 × 4 = 36
10 × 1 = 10	10 × 2 = 20	10 × 3 = 30	10 × 4 = 40
11 × 1 = 11	11 × 2 = 22	11 × 3 = 33	11 × 4 = 44
12 × 1 = 12	12 × 2 = 24	12 × 3 = 36	12 × 4 = 48
1 × 5 = 5	1 × 6 = 6	1 × 7 = 7	1 × 8 = 8
2 × 5 = 10	2 × 6 = 12	2 × 7 = 14	2 × 8 = 16
3 × 5 = 15	3 × 6 = 18	3 × 7 = 21	3 × 8 = 24
4 × 5 = 20	4 × 6 = 24	4 × 7 = 28	4 × 8 = 32
5 × 5 = 25	5 × 6 = 30	5 × 7 = 35	5 × 8 = 40
6 × 5 = 30	6 × 6 = 36	6 × 7 = 42	6 × 8 = 48
7 × 5 = 35	7 × 6 = 42	7 × 7 = 49	7 × 8 = 56
8 × 5 = 40	8 × 6 = 48	8 × 7 = 56	8 × 8 = 64
9 × 5 = 45	9 × 6 = 54	9 × 7 = 63	9 × 8 = 72
10 × 5 = 50	10 × 6 = 60	10 × 7 = 70	10 × 8 = 80
11 × 5 = 55	11 × 6 = 66	11 × 7 = 77	11 × 8 = 88
12 × 5 = 60	12 × 6 = 72	12 × 7 = 84	12 × 8 = 96
1 × 9 = 9	1 × 10 = 10	1 × 11 = 11	1 × 12 = 12
2 × 9 = 18	2 × 10 = 20	2 × 11 = 22	2 × 12 = 24
3 × 9 = 27	3 × 10 = 30	3 × 11 = 33	3 × 12 = 36
4 × 9 = 36	4 × 10 = 40	4 × 11 = 44	4 × 12 = 48
5 × 9 = 45	5 × 10 = 50	5 × 11 = 55	5 × 12 = 60
6 × 9 = 54	6 × 10 = 60	6 × 11 = 66	6 × 12 = 72
7 × 9 = 63	7 × 10 = 70	7 × 11 = 77	7 × 12 = 84
8 × 9 = 72	8 × 10 = 80	8 × 11 = 88	8 × 12 = 96
9 × 9 = 81	9 × 10 = 90	9 × 11 = 99	9 × 12 = 108
10 × 9 = 90	10 × 10 = 100	10 × 11 = 110	10 × 12 = 120
11 × 9 = 99	11 × 10 = 110	11 × 11 = 121	11 × 12 = 132
12 × 9 = 108	12 × 10 = 120	12 × 11 = 132	12 × 12 = 144

1 ÷ 1 = 1
2 ÷ 1 = 2
3 ÷ 1 = 3
4 ÷ 1 = 4
5 ÷ 1 = 5
6 ÷ 1 = 6
7 ÷ 1 = 7
8 ÷ 1 = 8
9 ÷ 1 = 9
10 ÷ 1 = 10
11 ÷ 1 = 11
12 ÷ 1 = 12

2 ÷ 2 = 1
4 ÷ 2 = 2
6 ÷ 2 = 3
8 ÷ 2 = 4
10 ÷ 2 = 5
12 ÷ 2 = 6
14 ÷ 2 = 7
16 ÷ 2 = 8
18 ÷ 2 = 9
20 ÷ 2 = 10
22 ÷ 2 = 11
24 ÷ 2 = 12

3 ÷ 3 = 1
6 ÷ 3 = 2
9 ÷ 3 = 3
12 ÷ 3 = 4
15 ÷ 3 = 5
18 ÷ 3 = 6
21 ÷ 3 = 7
24 ÷ 3 = 8
27 ÷ 3 = 9
30 ÷ 3 = 10
33 ÷ 3 = 11
36 ÷ 3 = 12

4 ÷ 4 = 1
8 ÷ 4 = 2
12 ÷ 4 = 3
16 ÷ 4 = 4
20 ÷ 4 = 5
24 ÷ 4 = 6
28 ÷ 4 = 7
32 ÷ 4 = 8
36 ÷ 4 = 9
40 ÷ 4 = 10
44 ÷ 4 = 11
48 ÷ 4 = 12

5 ÷ 5 = 1
10 ÷ 5 = 2
15 ÷ 5 = 3
20 ÷ 5 = 4
25 ÷ 5 = 5
30 ÷ 5 = 6
35 ÷ 5 = 7
40 ÷ 5 = 8
45 ÷ 5 = 9
50 ÷ 5 = 10
55 ÷ 5 = 11
60 ÷ 5 = 12

6 ÷ 6 = 1
12 ÷ 6 = 2
18 ÷ 6 = 3
24 ÷ 6 = 4
30 ÷ 6 = 5
36 ÷ 6 = 6
42 ÷ 6 = 7
48 ÷ 6 = 8
54 ÷ 6 = 9
60 ÷ 6 = 10
66 ÷ 6 = 11
72 ÷ 6 = 12

7 ÷ 7 = 1
14 ÷ 7 = 2
21 ÷ 7 = 3
28 ÷ 7 = 4
35 ÷ 7 = 5
42 ÷ 7 = 6
49 ÷ 7 = 7
56 ÷ 7 = 8
63 ÷ 7 = 9
70 ÷ 7 = 10
77 ÷ 7 = 11
84 ÷ 7 = 12

8 ÷ 8 = 1
16 ÷ 8 = 2
24 ÷ 8 = 3
32 ÷ 8 = 4
40 ÷ 8 = 5
48 ÷ 8 = 6
56 ÷ 8 = 7
64 ÷ 8 = 8
72 ÷ 8 = 9
80 ÷ 8 = 10
88 ÷ 8 = 11
96 ÷ 8 = 12

9 ÷ 9 = 1
18 ÷ 9 = 2
27 ÷ 9 = 3
36 ÷ 9 = 4
45 ÷ 9 = 5
54 ÷ 9 = 6
63 ÷ 9 = 7
72 ÷ 9 = 8
81 ÷ 9 = 9
90 ÷ 9 = 10
99 ÷ 9 = 11
108 ÷ 9 = 12

10 ÷ 10 = 1
20 ÷ 10 = 2
30 ÷ 10 = 3
40 ÷ 10 = 4
50 ÷ 10 = 5
60 ÷ 10 = 6
70 ÷ 10 = 7
80 ÷ 10 = 8
90 ÷ 10 = 9
100 ÷ 10 = 10
110 ÷ 10 = 11
120 ÷ 10 = 12

11 ÷ 11 = 1
22 ÷ 11 = 2
33 ÷ 11 = 3
44 ÷ 11 = 4
55 ÷ 11 = 5
66 ÷ 11 = 6
77 ÷ 11 = 7
88 ÷ 11 = 8
99 ÷ 11 = 9
110 ÷ 11 = 10
121 ÷ 11 = 11
132 ÷ 11 = 12

12 ÷ 12 = 1
24 ÷ 12 = 2
36 ÷ 12 = 3
48 ÷ 12 = 4
60 ÷ 12 = 5
72 ÷ 12 = 6
84 ÷ 12 = 7
96 ÷ 12 = 8
108 ÷ 12 = 9
120 ÷ 12 = 10
132 ÷ 12 = 11
144 ÷ 12 = 12

ALEXANDER'S NEW SPELLING BOOK

By GEORGIA ALEXANDER

District Superintendent of Public Schools, Indianapolis

The former edition, which was used with unvarying success, has been entirely rebuilt to meet the most modern and approved ideas of vocubulary and methods of teaching. It is now published as follows:

Grades 3, 4
Grades 3, 4, and 5
Grades 6, 7, and 8
Grades 5, 6
Grades 7, 8, and Advanced
Grades 3–8

This speller teaches spelling *through interest.* There is constant variety in the presentation of new words and in drill, and to further insure interest, the lessons have been purposely made short and the words and lessons very carefully graded. The deadening effect of approaching the spelling lesson each day in the same way is avoided by sometimes introducing the words to be learned in connection with the quotations from standard authors and model letters from celebrated men and women; sometimes in connection with elliptical exercises from classic fables and proverbs and not infrequently through the study of a picture.

VOCABULARY AND ARRANGEMENT

The common words of everyday usage alone are taught. These are purposely distributed so that each word invites to fresh attack and is therefore remembered as an individual. They are not arranged in the *sin, win, gin, ace, mace, lace* fashion. Homonyms are brought together in review lists, or after they have been learned separately. Column words are so arranged that the words brought together present an associated meaning or relation which readily lends itself to the formation of easy original sentences.

Daily incentive is also given the child to increase his own vocabulary by exercises in the use of the dictionary, word study, word building, word analysis, and etymology.

CONTENT BEFORE FORM

There is a thought basis for each lesson, so that the meaning of a word is developed before the child is required to learn the letters. After interest in a word has been aroused, the child's mind is concentrated upon the peculiarity of its spelling and appealed to through all possible avenues—the eye, the ear, and the hand. The image formed is thus so strong that it becomes individual, even personal. As a final test, the child is required to use his spelling words in original work.

MEASURING SCALE IN SPELLING

In the edition containing Grades 3–8 is a Measuring Scale for Ability in Spelling by Dr. Leonard P. Ayres of the Russell Sage Foundation. This consists of lists of words with the per cent of correct spellings to be expected among the children of different grades. The teacher can thus locate a child's spelling ability in terms of grades.

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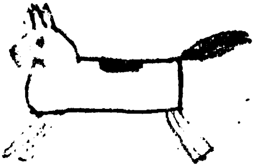
1379
+7
1a7
64

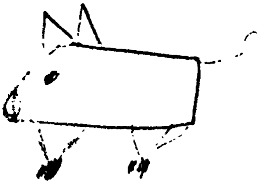
1379
+7
1a7
4

1576
+8
1a7
25

1c6

1378
+9
1a9
86





357
+9
6a7
6

2 | 4 - 6
2 | 2 - 3
3 | 1 - 3
1 - 1

d ?
4
64

4×2
64

3
294
252
84 |
42

Marechal Foch

Marechal
Foch

for extra credit

for extra credit

24/580 2
48
5

5/24